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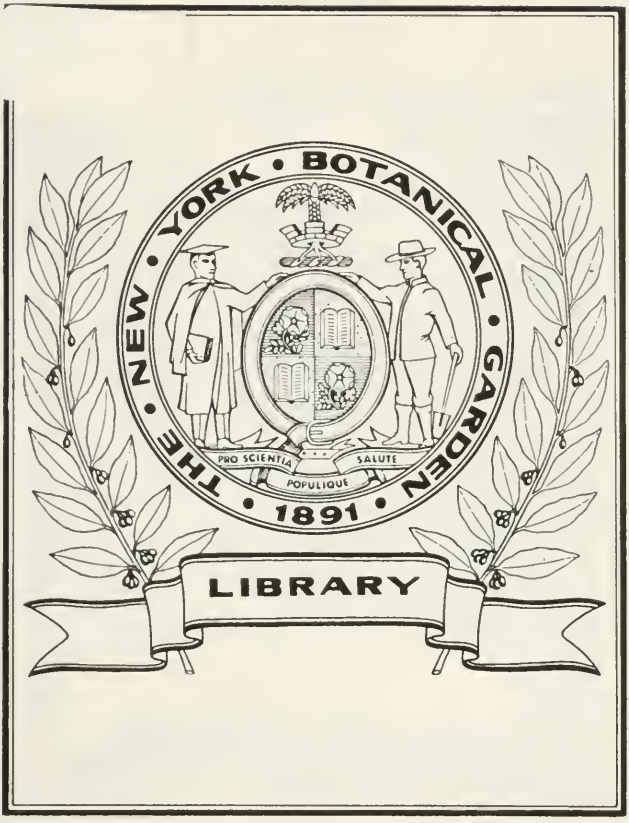
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ROYAL BOTANIC GARDENS.

BULLETIN

OF

Miscellaneous Information.

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EDITED BY J. H. HART,

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(QUARTERLY.)

JANUARY, 1904.

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Edited by the Supt. Botanical Department:

J. H. HART, F.L.S.

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576.—CONDITION OF THE SOIL.

IN confirmation of Article No. 561 in our last issue, I clip the following extract from *Agricultural News* of December 5, 1903 :—

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BACTERIOLOGY AND AGRICULTURE.

THE following report of a lecture recently delivered at Oxford by Professor R. Warringnon on 'The Assimilation of Atmospheric Nitrogen by the Agency of Soil Bacteria' is taken from the *Agricultural World* of September 5 :—

"Nitrogen had long been known to exist in plants, but until quite recently the original source of it was but very imperfectly understood. It was known that a certain amount was supplied in the shape of manure to the growing crops, but careful experiments showed that, in some cases, more nitrogen was contained in the mature plant than could have been obtained from the manure and soil together. Particularly was this noticeable with leguminous crops, such as clover, beans, peas, etc. Moreover, it was also found that besides containing more nitrogen in themselves, leguminous plants actually left more in the soil than was there at first, whilst cereals reduced the quantity and exhausted the land, thus necessitating the 'rotation of crops,' so well known in practice to every farmer. Whence, then, came the extra amount of nitrogen? An obvious theory was that it might come from the atmosphere, but investigations, made by Boussingault, Lawes, Gilbert, and Pugh, appeared to show that the plants had no power of directly assimilating free atmospheric nitrogen. A characteristic feature of all leguminous plants was the nodules, or small rounded lumps, which were attached to their roots; and it was demonstrated by Hellriegel and Wilfrath that when the plant was grown in sterilized sand, the nodules did not appear and the plant did not develop. If, however, a very minute quantity of ordinary fertile soil were added, the nodules immediately formed, the plant grew vigorously, and subsequent analyses showed that it contained far more nitrogen than was furnished by the seed and the soil. Schloesing and Laurent, experimenting with plants growing in fertile soil, proved that leguminous plants did actually consume atmospheric nitrogen: and on studying the nature of the nodules, Woronin, Marshall Ward, and others found that they contained a certain bacillus which, when associated with the plant, was capable of assimilating nitrogen from the air, and ultimately supplying it to the plant in the form of proteids. Attempts had thereupon been made to provide cultures of these bacteria on a commercial scale under the name of 'Nitragin," but in practice their use had been found to be wholly superfluous, and the manufacture had been discontinued."

577.—MICROBES AS POLICEMEN.

SIR WILLIAM CROOKES, giving evidence before the London Water Arbitration Board yesterday, said that he and Professor Dewar, in making daily analyses of the various supplies of London water, acted as the candid friends of the water companies.

Sir William pointed out that the word "impure" was often wrongly applied to microbic water. Quoting a French authority, he said that water that contains only ten microbes in a cubic centimetre was classed as "exceedingly pure," and with not more than 10,000 microbes as "pure."

Sir Edward Fry: Those microbes might all be friends?

Sir William: Yes. All friendly microbes. Most of them are policemen.

578.—LIME FLOWER ON SPINE.

The following paragraph is taken from the *Agricultural News* of December 5th, 1903. It is recorded here for local information:—

"Mr. J. H. Hart, Superintendent of the Botanic Gardens, Trinidad, has forwarded a botanical curiosity in the form of a flower developed on the spine of the lime plant (*Citrus medica* var. *acida*). Mr. Hart informs us that this occurred on the growth made after budding on a Seville orange stock. On the specimen sent there are a large number of spines, but only one has a flower, and that one is nearly twice the normal length."

579.—DISAPPEARANCE OF REDUCING SUGAR IN SUGAR CANE.

By H. W. Wiley, Washington, U.S.A.

(International Sugar Journal.)

"The occurrence of reducing sugar in sugar canes and sorghums has important relations to the metabolism of the plants. Presumably the carbohydrate which is finally formed in chlorophyl cells of these plants is some variety of starch, probably a soluble variety, since starch granules as such would find obstructions to circulation in the return currents from the leaves to the body of the plant. During the early stages of growth it has been shown by repeated analysis that the proportion of reducing sugar to sucrose in the juices of the sugar cane is very high. In Louisiana where the canes are harvested necessarily before the growth is complete, the average quantity of reducing sugars in the juice is one per cent. or more. In the tropics at the time of harvest the percentage of reducing sugars is very much less, usually less than one-half of one per cent. These facts show beyond doubt that the highest relative value of reducing sugar to sucrose is in the earlier stages of growth and the lowest proportion in the matured stages. Theoretically, then we might expect that at a certain period representing the complete and perfect maturity of the plant the reducing sugar would disappear. The further phenomenon, however, has also been observed, namely when the reducing sugar is reduced to a minimum on approaching maturity any deterioration in the plant due to long standing, over ripeness, injury from frosts or otherwise, tends to reverse the order observed during the growing period, and to increase the percentage of reducing

sugar at the expense of the sucrose. This reversibility of enzymic action has been well established in the case of carbohydrates. If the sugar cane, therefore, be allowed to normally grow and mature there is a certain time in its history as above mentioned, where the proportion of reducing sugar is at a minimum. The theory above outlined receives confirmation in some analytical data secured in this bureau recently on samples of sugar grown in Florida. Four samples were obtained which were all harvested at the same time, namely, the middle of May, 1903. The canes were grown by W. H. Abel, on Terra Ceia Island, Manatee County, Florida, about 150 yards from salt water. The soil is sandy to a depth of from 12 to 18 inches, with a thin stratum of chocolate coloured subsoil resting on clay which carries some pebble phosphate. The particular samples under question were grown on the edge of a field next to timber, and being in the outside row did not get much cultivation and practically no fertilizer. The samples were cut seventeen months from time of planting. The analytical data obtained from the four samples are as follows :—

Composition of the Juice.

Density Per cent.	*Sucrose Per cent.*	*Purity.*	*Glucose.*
21·0	19·0	90·5	None.
20·8	18·7	90·0	None.
20·4	18·0	88·2	None.
21·7	19·8	91·2	None.

These are the only samples of sugar cane ever analysed under my supervision which did not contain a greater or less quantity of reducing sugar. At the end of two minutes boiling of the juices with an alkaline copper solution there was no trace whatever of any reduction. On longer continued boiling and after allowing to stand overnight there was a mere trace of reddish precipitate due doubtless to the inversion of a part of the sucrose. A great many of the canes grown on this field produced tassels, but Mr. Abel did not state in his description whether the four canes sent had tassels or not. The presumption is that they had. We have in the above what appears to be an example of complete cycle of growth in the sugar cane, probably a cycle which would not be realised farther south. Evidently the cool nights of the winter had helped to complete the period of growth while at the same time they prevented a beginning of the second growth which would certainly have reserved the metabolic activities within the cane and secured an inversion of a part of the sucrose. It is probable that the meteorological conditions which produced so complete a growth do not often obtain, and the above data are therefore of interest both from a chemical and physiological point of view. The anasesere made in the Sugar Laboratory by Mr. A. W. Bache."

580.—MILLIPEDES AND CENTIPEDES.

To many local residents these "creeping things" are looked upon with considerable horror, and the general idea is at once to kill when seen. In the following article their general habits and life

history are well described. It will of course be seen that the article treats of European species, but as the habits of Tropical species are similar it will be a useful guide to the study of the Life History of the latter.

"Millipedes and centipedes belong to a group of the animal kingdom known as *Myriapoda*. These animals are recognised by having legs on every ring or segment of the body. In the case of the millipedes there are two pairs of legs to each segment; in the centipedes, one pair only. It is important to notice these differences, as the millipedes are injurious, and the centipedes are beneficial.

They are found in all manner of places, both in the field and in the garden, and are especially attracted by decaying vegetation, such as heaps of leaf mould, rotting stalks, &c. They are also found crawling about under the bark of trees and in the soil. The difference in structure is also accompanied by a difference in habits: centipedes are very active and are carnivorous, whereas millipedes are mostly herbivorous, and live upon sound and decaying vegetable matter. The millipedes have the mouth formed for chewing, there being powerful biting mandibles with which to devour the roots of plants. Centipedes are provided with poison claws. The bite of some centipedes in the tropics is very poisonous to man, but none are so in this country. Millipedes are often known as "false wireworms," but they can easily be told from the true wireworm by the great number of legs.

Description and Life-History.

The female millipede (*Julus terrestris*) deposits her eggs from May to July in a nest made of pieces of earth fastened together with saliva; this nest is round in form and has a small hole at the top through which the eggs are dropped. The eggs vary in number from 60 to 100. The hole is then stopped up and the eggs mature in from 10 to 14 days. The young millipedes have only three pairs of legs, the others appear in groups by degrees. Growth in a millipede takes place by lengthening at the posterior end, the growth evidently taking place between the penultimate and last segments. Miss Ormerod states that millipedes lay their eggs from December to May, but as this does not agree with Sinclair's statements, the observations were probably made on different species.

The most injurious millipedes belong to the families *Julidæ* and *Polydesmidæ*. The latter are the *flattened* snake millipedes. The most troublesome millipede is *Julus pulchellus*. This is nearly half-an-inch long, slender, about the thickness of a fair sized pin, pale yellowish-pink in colour, with a double row of purple spots on it. *Julus terrestris*, another common species, is black and has a pointed tail. These *Julidæ* feed upon all manner of roots. The smaller *Julus pulchellus* also eats into potatoes and lilies, often hollowing them out completely: the larger species, according to some observers, also feed upon snails, slugs and some insects. The common species of *flattened* millipedes, *Polydesmus complanatus* is of a pale purplish-white to dull rosy tint, and is nearly an inch long, with the sides notched.

Centipedes, or *Chilopoda*, are beneficial, the food being composed of snails, slugs, and ground insects. Three of the commonest genera are *Lithobius Geophilus* and *Scolopendra*. The eggs of *Lithobius* are

laid from June to August; they are about the size of a number five shot, spherical in form, and covered with a sticky slime. The female after laying an egg rolls it about in the earth until it is all covered with soil and resembles a grain of earth. A small number only are laid by each female; and the males frequently devour the eggs before the female coats them with earth. In the other genera the number probably varies to some extent. *Geophilus* is said to lay its eggs in an earthen cell; *Scolopendra* to bring forth living young.

These pests are frequently distributed with leafmould, which should, therefore, be examined before being used, and if found to contain them should be mixed with lime. Their numbers in the field may also be lessened by broadcasting lime over the surface and working it into the soil. Soot-and-water, in the proportion of a handful of soot to the roots of garden plants for a time. They may also be trapped in numbers by placing pieces of mangolds scooped out just under the ground near the plants they are attacking; they swarm over the baits and may then be collected and destroyed.

Another certain way of killing them on small areas is by injecting bisulphide of carbon into the soil. They may also be trapped by soaking decaying cabbage leaves or decaying roots in Paris green and placing them about in gardens: the millipedes feed upon them and thus get poisoned.—Leaflet *Board of Agriculture*. England."

4, Whitehall Place, London, S.W.,
October, 1903.

581.—FUNGI AND DISEASE.

Many of the most destructive diseases of both wild and cultivated plants are due to the attacks of fungi. The ways in which these fungi attack and damage plants are numerous and varied, and a study of them may be of interest to cultivators, as giving some idea of the methods by which the various diseases may be guarded against and dealt with.

A few fungi cause damage simply by absorbing food material from their host plants and so weakening these that they die of malnutrition. This, however, is not common. Generally, the stealing of food by the fungus is the least part of the damage done, which is only indirectly due to the activity of the fungus.

Take, for instance, certain fungi which live on the surface of leaves. Some of these—the common 'black blight' is one—simply live on the surface of the leaves and take no food from them at all. They damage the host, however, by cutting off a certain amount of light, and so reducing the amount of starch or sugar that is formed in the leaves, when these are exposed to light.

Other leaf diseases are caused by fungi which live inside the tissues. Here again, the actual amount of food taken by the fungus is insignificant, even when the whole leaf is destroyed. But the

leaves are the parts of the plant which build up the organic plant food, and so when these are destroyed, the supply of this food is cut off. The cotton leaf rust may be taken as an example of this group of parasites.

Other fungi inhabit the water-carrying tubes, the wood vessels, of the plant. Their hyphæ fill up the cavities of these vessels and so the current of water containing food salts in solution, which is passing up from the roots to the leaves, is interrupted. These hyphæ, of course, absorb part of the food supply which is passing up the vessels, but the damage is comparatively small, compared with that done by the stoppage of the current of water. The dangerous disease of cotton, known as 'wilt,' causes damage in this way, filling up the vessels of both root and stem with its hyphæ and causing the leaves to wilt. The fungus of the rind disease of the sugar-cane is another that inhabits the vessels of the stem. Other fungi similarly attack the walls of the wood vessels and destroy them, and in this way render the vessels incapable of conducting the water current.

Another group of fungi attack the actively growing regions of the different plant organs, and so stop the growth of the organs. The fungus causing the root disease of the sugar-cane may be classed here. The fungus mycelium attacks the growing points of the young roots as they emerge, thereby rendering their further development impossible. In this way the plant is unable to absorb the necessary water and food salts from the soil, and so gradually dies of starvation, although the amount of food actually taken by the fungus from its host is small.

Canker diseases are caused by fungi that attack the cambium, the tissue that forms new wood, &c., of the stem. At the point attacked the plant is unable to form new wood or new bark, and as this formation goes on elsewhere, a canker is formed. As the fungus grows it gradually spreads, killing the cambium all round the stem, and the death of the plant follows.

Again other fungi, the hyphæ of which live inside the host, kill the plant tissues by the secretion of poisons into the cells The fungi that cause the "damping off" diseases may be mentioned as examples of this class.

Other fungi simply attack the fruits or parts for which the host plant is cultivated. In this way, although the damage done to the plant itself may be slight, the crop, so far as the cultivator is concerned, is spoiled. Fungi that cause leaf-spot diseases of tobacco, others that cause malformed fruits, and others that attack the bolls of cotton and damage the quality of the lint may all be considered under this head.

There are many other ways in which fungi may cause damage, but from what has already been said, it will easily be seen that a plant has many vulnerable points, and that a fungus which makes a successful attack on any one of these may be as dangerous to the plant as, say, a grazing animal which comes along and eats up the whole.—From *Agricultural News*, Barbados, November 7.

582.—EDUCATION FOR THE IMPROVEMENT OF AGRICULTURE.

The following extracts are from an address on Education for the Improvement of Agriculture, delivered at Halifax, by Mr. James W. Robertson, the Commissioner of Canada:—" * * * Our progress is made by advances in education and agriculture. The only sure way of advancing any worthy interest is by the application of intelligent labour—there is no other means. The application of intelligent labor affects the individual and his occupations, it affects his locality, it affects his province, it affects the whole country. Whether a man gathers wealth out of a gold-mine, or whether he accumulates it at home, or remains reasonably poor, he makes progress in himself by the application of intelligent labour: and the intelligent quality in his labour depends upon the measure of his education. For educational purposes we have established school houses and colleges; and in passing I may say that there is a heap of foolishness in the mind of ordinary society as to what constitutes an educated person. A good many suppose that the obtaining of a degree from a college, or the having in one's possession a parchment from some such institution, insures the enjoyment of an education. A few of the most helpless men I have ever known were fellows who owned a piece of parchment like that. They never had educational experiences that lead to the ability to do things, to bring things to pass at the right time in the right way. When I say that intelligent labour rests upon education I do not mean to say it rests upon the number of days a man may have gone to school or the number of days or years he may have attended college. What I mean is that it rests on the experiences of life that lead to ability to think, to know, to do and to manage life and things. Are we giving the young people of this province a fair chance to gain the ability to manage things on the farm? If we have not done so in the past can we not do so now? I think we can. * * * I would like to mention instances of a few ways in which agriculture is being developed elsewhere or is being developed here. It is wise to take note of all the methods and means that have been successful. I think it is foolish for a man to say that he will start from the beginning without first doing that; such a man would proclaim himself a fool in any practical undertaking. The most that any people of any generation can do is to improve a little on what their forefathers left them. You have made progress along several lines. Cannot these lines be broadened and lengthened; can new ones be joined to them, while still getting full service from what has been found useful in the past? There is need for more knowledge among people who farm in regard to managing the natural forces in accordance with the laws that govern all plant life and that govern all animal growth. There is a real difference between knowledge and ability. There is a wide difference between soil physics and practical tillage. Every man who understands soil physics can manage land and crops better than if he did not understand the principles. Knowledge will help every man to greater ability, but it does not in itself constitute or confer business ability. A man may know all about the composition of a soil and still be a

poor farmer. Therefore, some one may say, "Throw knowledge to the winds." Not so. Every man does better in so far as he knows more and knows better, but a man may know much and not be able to apply it. There is a difference between scientific knowledge and the business application of it. Huxley once said he could not grow as big turnips as Hodge, but he could tell Hodge what would enable him to grow still bigger turnips and to make more money. The agents who become instruments of progress in farming and other affairs, are Men, Knowledge, and Wealth. With the efficiency of these as factors, and with the effectual use of them as means, education has nearly everything to do. Some one asks, "Does education pay?" That is a question put by the citizens who pays the taxes? What does pay? What is worth while? What is life itself and the world worth to anybody? Nothing, except as they provide for and make for richness of experiences. You may stick everything which he can desire around a man, and what would they be worth to him unless they help to enrich his life, his experiences? If you put flowers around a blind man with no sense of smell, of what use or benefit would the flowers be to him? However, the presence of a blind man does not abolish the beauty or fragrance of the flowers in your garden. The use of faculties trained to the widest range of enjoyment, is what makes for the richest experiences in life. Education itself is a series of experiences leading up to personal intelligence, ability and selfishness. It is not a remembrance of names, although sometimes memorized knowledge of a second-hand sort has been counted its object. It is a series of experiences from the doing of things, whereby ability is gained to enjoy things and to enjoy life. In every sense education does pay. It is the one thing that enriches the life of individuals and nations. As nations have ideas and ideals, so they live and lead, and thus are they powerful. What is China with her six hundred millions of people? And she has had bookishness and examinations for centuries. On the other hand, Germany is training the hands as well as the heads of her boys. Her schools and universities are progressive, and the country is making great headway, not only in the arts and sciences, but in all that gives power to dominate in human affairs. Let us rather follow the modern German methods, and not be led any further in the Chinese way of doing things in our common schools. Education always stands for some sort of power—power to see, power to know, to understand, to do, and therefore power to be. If we are now on similar lines of thinking regarding education: let us consider in what further respects our agriculture may be developed by the application of education. There are some difficulties in the growing of crops. Pests become more numerous and persistent. There are difficulties in maintaining the fertility of the soil. Land will run out if it is not well managed: but the land of France, under an adequate system of education for agriculture, has been so improved that the average yield of crops per acre is said to have been doubled in less than forty years in that old country. On the other hand there is a possibility of the fertility of our soils—our almost virgin soils—disappearing for want of that intelligent management which alone makes land grow richer and more productive. There are the difficulties of keeping live stock with profit. Many men board too many animals without getting pay for

their keep. It takes a competent man to so manage stock as to get a profit out of it. There is need of more knowledge in preparing the products of the farm for market. Last year hundreds of barrels of fruit sent to England had far better been dumped into the sea, not merely because there was no return to the shippers, but because such shipments gave a black eye to the good name of the fruit of the province in the London market. And this is not the only province of which that is true. You must know the proper market, and you must know how to prepare your products for the market, otherwise there is a loss instead of a profit."

583.—THE PINE-APPLE, ITS COMPOSITION AND CULTIVATION.

The Pine-apple is an important fruit in Jamaica. Recently the exports have been fluctuating, and have somewhat diminished, but the diminished export is not to be wondered at when the long drought of eleven months out of twelve in 1902–1903 is taken into consideration. The exports are principally to the United Kingdom, the United States and Canada.

Botanists have placed the pine-apple in an Order the type of which is the *Bromelia Pinguin*, our common pinguin, much used for fences some years ago. The Bromeliads or Bromeliaceæ constitute a large group of tropical plants, including as it does the numerous air-plants or "wild pines," so common in Jamaica. The scientific name of the plant is the *Ananassa sativa*, indicating its production from seed, though as an actual fact this method of reproduction is not much resorted to, although it is of much value in the direction of producing new and improved varieties by hybridisation.

It is always an important matter for the cultivation of any given plant to know its composition as to the mineral matter which it takes up from the soil; such knowledge will always remind him of the natural requirements of the plant, and will enable him all the better to carry out an intelligent and successful cultivation. The late Mr. John James Bowrey, for many years Official Chemist in this island, has left us an instructive analysis of the ash or mineral matter of the pine-apple, which was published in the *Bulletin* of the Botanical Department for October, 1896, page 236. It is as follows:—

Potash (K_2O)	49·42
Chloride of Potassium (KCl)	0·88
Chloride of Sodium (NaCl)	17·01
Magnesia (MgO)	8·80
Lime (CaO)	12·15
Phosphoric Acid (P_2O_5)	4·08
Sulphuric Acid (H_2SO_4)	Trace.
Silica (SiO_2)	4·02
Phosphate of Peroxide of Iron..	2·93
	99·29

There is no mention in the Bulletin of the relative proportion of ash to the weight of the fresh fruit, a matter which is to be regretted, in the view that the pine-apple is generally regarded as an exhausting crop to the land on which it is grown, and also in the view that every

three years the plant should be changed to fresh soil. Mr. Bowrey, however, gives the following suggestions as to manuring the pine-apple:—"Judging from this analysis of the ash of the pine-apple, potash is the most important mineral substance which it requires. Of course, phosphoric acid is also necessary, and so are lime, magnesia and iron: but it must be a very rare soil which does not contain iron and magnesia in ample quantity, and usually there is enough lime also present. It is difficult to make suggestions respecting manuring in total ignorance of the nature of the soil to be manured. But certainly no harm can be done and probably much good by adding phosphoric acid and potash to the soil: the former best as finely ground basic slag, price about 55s. per ton f. o. b. in England. A dressing of from five to ten cwts. per acre will supply phosphoric acid for three or four years and also some quantity of lime. The potash can, I think, be obtained here or imported into Jamaica most cheaply as muriate of potash; its price is about £8 per ton, f. o. b. in England. From one-half to one cwt. per acre would be a dressing for a year. But the pine-apple also requires nitrogen for its growth: this might be supplied as nitrate of soda at £10 per ton, giving one cwt. per acre when the plants have started to grow rapidly."

The combination of muriate of potash with nitrate of soda in about equal proportions has been regarded by many chemists as a practical method of supplying nitrate of potash cheaply to the soil. The combination is largely used in France in horticulture. It has been recognised that muriate of potash when used alone as a source of potash to a soil deficient in this constituent is liable to failure, and many cases of disappointment occurred in France soon after its introduction mainly on the recommendation of Mr. George Ville. These failures led to an investigation by M. Crochetelle, who finally showed that for the muriate to become assimilable by plants it had first to be converted into the carbonate. In the form of carbonate it is readily converted into the nitrate by the agency of the nitrifying organisms contained in the soil. The great fact in the natural history of these organisms is that they live on the element carbon, extracting it from carbonates, and liberating at the same time their oxygen to oxydise nitrogenous compounds into nitric acid and nitrates. Potash and nitrogen are chiefly taken up by plants in the form of nitrates. The value of chemical manures in the cultivation of the pine-apple is not to be disregarded, because it will be by the aid of nitrate of soda, salts of potash, and preparations of phosphoric acid that the cultivation of the pine on the same ground can be kept up. Mr. Bowrey's advice to employ basic slag must be regarded as valuable, more especially so in the pineries of St. Andrew, where lime appears to be a difficient constituent in some of the fields devoted to the pine-apple. The basic slag yields up its constituents slowly and apparently just according to the requirements of the plant, a fact which makes this waste-material very useful in horticultural cultivations, including the vine. The essential nature of lime as a food for the pine-apple will be evident from Mr. Bowrey's analysis. It is doubtless the more abundant presence of lime in the soils of Clarendon which gives an advantage to the growers in that part.

The cultivation of the pine-apple is a matter of much practical interest: it requires the constant attention of the cultivator, but the

necessary attentions are of much interest from the responsive nature of the plant. It responds freely in fact to good cultivation, and will not thrive except under good cultivation. It must be kept free from weeds, constant tillage and a free loosening of the soil being of obvious advantage in the steady and useful growth of the foliage, which is a necessary preliminary to the growth of the fruit. The native sorts of pines lend themselves readily to a rapid mode of reproduction, by the growth of slips and offsets; even the small slips often formed at the base of the crown of the fruit known as cockscombs, may be used for multiplication, and they will come true to the mother-plant, but these modes are not advisable from the practical point of view. The best mode of reproduction is to make use of the offsets which spring mostly from the lower foliage of the plant, but which also sometimes spring up through the soil from the roots and are then known as "suckers." An offset or sucker should be taken and set out when it is about ten to twelve inches in length; if taken later it will be almost sure to give a plant which will mature too soon and give an imperfect fruit that will be of no value, whereas if taken at the proper period mentioned, the result will be a plant that will attain full maturity and yield in due season a good marketable fruit. When an overgrown offset or sucker has to be set out, it would be better to stop its flowering at the first moment and so obtain a good multiplication of better plants.

Besides the native sorts, chief amongst which are the three Ripleys, Green, Red, and the Queen Ripley, the smooth Cayenne ranks best as a "fancy pine." This sort has gained its excellent qualities chiefly by long cultivation under glass, at first, it is believed, in England, but later in the Azores. In Jamaica there are two sorts of Smooth Cayenne, a good sort and a very poor sort, the latter being known as the Honolulu, on account of the place of its principal production. This variety should not be chosen by good growers who wish to obtain choice fruit.

The pine-apple readily responds to proper manuring. The writer has tested with advantage the various applications of sulphate and nitrate of potash, applied experimentally to very young plants. The sulphate had a visible effect when applied alone; the effect was markedly increased when lime was added along with the sulphate, but the best effect resulted from the application alone of nitrate of potash, or saltpetre, in small and repeated quantities. The nitrate of potash, however, is too expensive for general cultivation. Therefore, as a practical manure we had to fall back upon leaf-mould, so highly recommended by Mr. Spon. At Limetta, in Clarendon, we had a good supply of leaf-mould obtained from the base of a large Mountain Guava, growing wild in the forest, where it formed a heap of spent vegetable material at the base. Leaf-mould is in fact made up of most of the mineral substances mentioned in Mr. Bowrey's analysis, and is usually rich in lime. Practically, it helps both the foliage and the fruit.

Annual cultivation is now coming into vogue, that is, the offsets are set out annually in recently worked soil, and it is claimed that an advantage is gained thereby. Experience is wanted, however, to determine the value of this mode. The distance apart at which the

plants should be set is also a matter which is undergoing a change among good growers in Jamaica. Formerly it was considered good practice to set out the plants in rows at two feet apart and at one foot and a half between each other in the row. Later, this practice is being changed to much closer planting, eighteen inches apart being the distance now grown in newer cultivations, with drains or working paths between the rows, six plants in width and ten or twelve in the row. This compact method of planting gives a large increase in the number of plants for the area taken up, and it is held to be of special advantage for the cheaper and commoner sorts, though in point of fact the fancy Smooth Cayenne has been subjected to the same treatment. Experience will have to determine among growers which of these plans will suit their soils the best.

The slips should always be prepared prior to being set out. This is done by removing the lower scales and leaves from the offsets or suckers. If these leaflets be left on, the young plant will be retarded in its growth from the fact that the young rootlets formed in the axillary buds of the leaves will be forced to wind round the plant before arriving in the soil which is their obvious destination. This important fact is easily susceptible of demonstration. The plan is practised by the best growers.

Second only to the important part played by careful weeding and good tillage, is the pruning of fruit. This consists in the early removal of buds and slips from the stem of the fruiting plant, with the object that the sap shall be wholly diverted to the nourishment of the forming fruit. It is the plan of the early English and Scottish hot-house growers, who did much in the last century to bring the cultivation of pine-apples to perfection in their pineries and bark-pits. By close observation they were enabled to attend to the daily wants of the fruit, and their records of cultivation handed down to this day are not unworthy of examination.

Drainage of the soil plays a very important part in the proper cultivation of this very sensitive and susceptible plant. In a wet subsoil it is sure to be attacked by a fungoid disease known mostly as "Ripley spike." Plants so attacked should be removed to drier ground. If, on being taken up, they are seen to be only partially affected, much may be done to arrest the disease in the root by immersing it in a solution of sulphate of iron, which is one of the best of cryptogamicides, as we know from the experience of French horticulturists, who make frequent use of this agent. This substance is usually employed in solutions of about five per cent., but weaker solutions often answer a useful purpose. Concentrated infusions of strong tobacco, made from the stems, are also in use for the same purpose, and for helping the young plants to take on a healthy growth when planted out.

The packing of plants for market is a special matter, much advance in this respect having been made in Jamaica of recent date by our growers, who now prefer to pack good sorts in much smaller crates than was recently the case. It is a matter for congratulation that crates are now being made in the island from native woods, and that

the practice of packing is now making headway. Only the common sorts are packed in barrels, the better kinds being packed in specially constructed crates, steadily assuming a smaller size, so that all the fruits contained can be inspected at a glance by the purchaser in London, Liverpool, or Manchester. It is by following in this direction that a better and more reliable market can be obtained and kept.—From Journal *Jamaica Agricultural Society*.

J. N.

584.—COLLAR ROT, OR MAL DI GOMMA, OF CITRUS TREES.

This is, unfortunately, one of the best known of citrus diseases, for it occurs wherever oranges or lemons are grown, often causing serious loss. The first mention of it was in connection with the orange-groves of the Azores, where it seems to have originated, and was noticed as early as 1832. Like many other diseases, it attained its maximum, then began to decline, and about forty years afterwards its force was spent, and it ceased to be regarded as serious.

Meanwhile it spread to Southern Europe, and afterwards appeared in Florida and California. It has now obtained a footing in Australia, and annually causes considerable loss. From the very nature of the disease, which attacks young and old trees alike, and may sometimes "ringbark" them in the course of a few months, entire groves are either destroyed or rendered almost worthless. It is generally spoken of as a mysterious disease, but the discovery of the parasitic fungus causing it has brought it within the domain of rational treatment.

Symptoms.—The disease has often made considerable progress before the grower is aware of its presence, because it begins so low down that it is overlooked. One of the first indications is the exudation of drops of gum at the neck of the tree, and this is so constant, that where there is no gumming some other disease is at work. It would appear that the fungus parasite excites the flow of gum for its own convenience, for I found numerous conidia actively germinating in it, and producing filaments at either end or laterally. The gumming may occur at one or more spots, and the bark at the same time becomes discoloured. The browning of the bark is the sign of rotting, which gives rise to a decidedly disagreeable odour, and the bark gradually rots away and is thrown off. If the tree is able to renew the bark and arrest the progress of the disease, further mischief is prevented, but usually the disease runs the following course:—The cambium layer, which lies between the wood and bark, is the formative portion of the stem, giving rise to new wood on the inside and fresh bark on the outside, and containing the necessary elements for building up. The object of the parasite seems to be to reach this treasure-house, and accordingly the decay reaches the cambium layer, and even extends to the wood. When this happens there is no possibility of the renewal of the bark, and that portion is dead. Then the disease spreads further in all directions, principally around the base of the stem and down to the main roots. Gradually the diseased area is extended, the tree is completely girdled, and death ensues. While this is taking

place near or beneath the ground, the foliage is affected, and becomes yellow and sickly from the insufficient supply of nourishment from the roots.

The exudation of gum at the collar, the decay of the bark there in patches, and the consequent disagreeable odour, the unhealthy appearance of the foliage, and the death of the small shoots, are all symptoms of this disease.

Generally the first visible intimation of the disease is the fruit setting abnormally thick, and the foliage turning a sickly yellow colour. This fruit-setting is an evident effort of the tree to provide successors before it finally perishes.

Effects.—When trees are attacked, they may produce an extra large crop of fruit the first season, but this is usually the expiring effort, and little or none is produced afterwards. In a few months the "ring-barking" of the stem may be almost completed, and, as the disease spreads from tree to tree, in the course of a few years entire orchards may be devastated. The progress of the disease will be rapid or slow according as the conditions favour it or otherwise.

The healthy root action is interfered with, and there is a deficiency of nourishment: the foliage is affected and is unable to assimilate properly; the girding of the stem prevents that free communication between root and leaf which is essential to plant growth: and finally, with the destruction of the cambium layer—the centre of vital activity—the tree is doomed.

Conditions favouring Disease.—The conditions which favour the disease are often confounded with the cause: but we must distinguish between them. They are what may be called predisposing causes—conditions which affect the plant injuriously and render it liable to the attack of the fungus parasite. They may be guilty of aiding and abetting and preparing the way for the fungus, but of themselves do not induce the special disease known as "collar rot." As far as known, it is necessary that this particular fungus invaded the weakened tissue in order to produce the characteristic symptoms which we speak of as the disease: and whatever is antagonistic to these conditions, or destructive of this fungus, will tend in the direction of preventing or remedying the disease. Unsuitable soil is said by some to produce the disease, because it always occurs towards the base of the stem, near to or beneath the surface of the soil; but transplanting the trees to similar soil may lead to their recovery. Sudden changes in the temperature of the soil surrounding the stem are also supposed to induce it, the sudden and extreme variations affecting the regular flow of the sap and producing contraction and expansion of the bark.

The want of proper drainage is likewise a contributing condition, because it will prevent the perfect aeration of the roots, and the water may be allowed to lodge around the stems.

Close and *deep planting*, producing an excess of shade and a deficiency of feeding roots: *excessive irrigation*, keeping the soil soaked with water: *excessive cultivation*, which may tend to injure and disturb the roots: and the *continuous use of organic fertilizers*, are all said to encourage the disease.

Propagation by grafting is also found to render the tree susceptible at the junction of the scion and stock, and, as will be shown more fully later, certain varieties and certain stocks are found to be highly resistant to the disease. It is generally stated that the use of lemon stock renders the tree specially liable to this disease.

There is a totally distinct disease, known as "root rot," which is often confounded with "collar rot," commencing at or near the extremities of the roots and proceeding upwards until the tree is killed. The malady is due to quite a different cause, and will be discussed afterwards.

How the Disease may be spread.—If the gum exuding from an affected tree is examined it is found to contain innumerable reproductive bodies of the fungus, or *conidia*, as they are technically termed; and not only so, but these bodies are actively germinating, and so capable of growing on any suitable medium and reproducing a similar fungus to that from which they originated. Suppose a little portion of this gum, containing these *conidia* at the stage when they are ready to germinate, is conveyed by any means to a citrus tree under favourable conditions for the growth of the fungus, then we may expect that the disease may appear. It is thus highly probable that the tools used for purposes of cultivation may carry the germs of the disease from infected to healthy trees, or from diseased to healthy groves. Besides, the gum may act as a preservative for the conidia, and thus prolong their vital activity. During irrigation, gum with conidia might easily be carried from diseased to healthy trees, more especially when the water is allowed to flood up to the trees. It is not maintained that this is the only way in which the disease is spread, but it is sufficiently evident to be worthy of being guarded against.

Treatment.—This will be based upon a knowledge of the immediate cause of the disease—in this case a fungus—and of those favouring conditions which have been found by experience to predispose or render the trees susceptible.

1. There is a general remedy which has been found applicable to citrus trees affected with diseases due to fungi, and that is to cut away the diseased portion, taking care to remove every trace of it, and, to make sure, a little of the apparently healthy tissue surrounding it as well. This has been found successful in bark diseases generally, and of course every such diseased portion should be burnt. The wound will generally heal, and the further progress of the disease be stayed.

2. In order to prevent infection from stray conidia, or from filaments of the fungus which may still be in the surrounding tissue without external signs, some antiseptic solution should be used to dress the wound.

(*a.*) It has been found that painting with *carbolic and olive oil*, mixed in equal proportions, will prevent any further extension of the disease.

As the result of the Florida experiments, the following solutions are also recommended :—

(*b.*) *Sulphurous acid* in the proportion of 15 to 85 parts of water. This may be used to wash or paint the wound, or it may be sprayed on the exposed roots.

(*c.*) *Carbolic acid*, in the proportion of 1 part of crude acid to 1 part of water. This may be used to paint the wound or sprayed on the roots when diluted in the proportion of 1 to 5.

(*d.*) *Sulphur wash.* This is generally a useful preparation, and consists of flowers of sulphur and caustic soda. To make a stock solution, place 30lbs. of flowers of sulphur in a wooden vessel and mix it with sufficient water (about 12 quarts) to make a stiff paste. Add to this 20lbs. of finely powdered caustic soda, and mix thoroughly by vigorous stirring. The mass becomes hot, turns brown, boils, and liquefies in a few moments. When the violent boiling has ceased, add water to bring it up to 20 gallons, and strain into a barrel, which can be kept tightly corked.

Formula—Flowers of sulphur...	... ...	30 lbs.
Caustic soda (NaHO)	... ...	20 lbs.
Water	... ...	20 gallons.

For covering wounds, 1 part of this stock solution is to be added to 1 part of water, and for spraying the roots 1 part to 10 parts of water.

Even coal tar has been used as a dressing.

3. As imperfect draining prevents the proper aeration of the soil, and as this seems to favour the development of the fungus, the removal of the soil and the *exposure of the roots* to the air will often of itself prove effectual. In removing the soil, care should be taken not to injure the healthy roots, and a few pounds of slacked lime might be applied. Proper drainage of the soil is thus a good preventive of the disease.

4. As highly *nitrogenous organic manures* seem to encourage the fungus or predispose the tree to its attacks, avoid them.

5. Avoid *close planting*, as the excessive shade thus produced is favourable to the fungus, apart from its injurious effect upon the trees.

6. *Transplanting* badly affected trees and giving them plenty of room has also been found beneficial.

7. Avoid *deep ploughing* close to the tree, as the roots are thereby often injured, and the entrance of the parasitic fungus encouraged.

8. Generally speaking, whatever encourages the healthy growth of the trees should be attended to, and whatever weakens their vitality should be avoided. As citrus trees are very sensitive to water lodging at the roots, irrigation should be used in moderation, and if water is allowed to flood the whole surface, the germs of the disease may readily be transferred from one tree to another, and the drainage should be good in order to provide for the perfect aeration and the equalisation of the temperature of the soil. Deep planting and deep cultivation should be avoided, and too close planting prevents the free access of light and the proper development of feeding roots.—Journal *Jamaica Agricultural Society.*

585.—WHAT IS A GOOD DAIRY COW ?

The Dairy Industry of Jamaica has in recent years been advancing on improved and modern lines with the result that there is a more regular supply of pure milk in the towns and an increasing demand for fresh butter. In consequence a demand for good dairy cows has been created, and the good familiar advertisement, "Wanted a good dairy cow." is seldom absent from the columns of our daily papers. The question I now want to establish is, what is the Jamaica standard for a good dairy cow ? Whereas ten years ago six to seven quarts a day was considered good, now we hear of sixteen and twenty quart cows According to the custom in Jamaica I here use the word quarts, but I think it is high time all dairymen substituted pounds for quarts and estimated the milking standard of their cows on a basis of the number of thousand pounds yield per annum. It requires no pencil and paper to convert pounds into quarts, 3,000 lbs. = 300 gallons or 1,200 quarts, this is I consider the minimum yield required of a cow in order to give a fair return to the dairymen for his care and feeding. It is a common custom among dairymen, in other countries besides Jamaica, to award to the cow that gives the largest quantity in any one day the distinction of "Best Cow in the Dairy," but if careful daily records of each cow's yield were taken, dairymen would be surprised to learn how often they are deceived by the cow that gives the largest quantity when fresh in milk. The year's product is the only thing that counts when you balance the year's account, and if daily records were taken it would be found that the persistent eight quart cow, milking ten months in the year and idle two, came out better in the year's record than the cow that had a record when fresh, of sixteen quarts and over.

The standard I have fixed for my own guidance and which is based on my experience of selected native bred cows is as follows :—

Fair, 3,000 lbs. (1,200 quarts), to 4,500 lbs. per annum.
Good, 4,500 lbs. (1,800 quarts), to 6,000 lbs. per annum.
Very Good, 6,000 lbs. (2,400 quarts), and upwards per annum.

This, I think, might be accepted as a standard for dairymen in Jamaica to work by at least for some few years more. In my own dairy of 30 native cows at this rating I have 22 fair, 7 good, and 1 very good, and anything below 3,000 lbs. I have no place for.

The aim of every dairyman should be to improve the milk yield by weeding out the poor unprofitable cows and replacing them by better, but to arrive at this he must first keep a careful record and weigh the milk at each milking. It only means a little trouble, a spring balance, and a book with a column for each cow, but it is worth it ! Let your milk buckets be all exact weight to even pounds so that the tare can easily be deducted, and at the end of the month total up the return from each cow and record it, take a note of the days she is idle, and when her 365 days are up you will have a record that will be worth to you many pounds. Your weight book is the best and surest indication of the health of your cows, and the value of your feeding, it tells you daily if your cows are properly milked and cared, and whether or not your cows are profitable

The following is an example from my own dairy, showing how important it is for dairymen to keep records, and how impossible it is for them to know what their cows are doing without them :—

This cow milked for ...	...	233 days and gave 2,676 lbs of milk.
Was dry for ...	...	71 days.
Dropped another calf and in the next		61 days and gave 976 lbs of milk.
	365	3,652

I had decided to get rid of this cow on the apparently poor form shown in the first 233 days, but after making up her record for the year I was agreeably surprised to find that her yield was 652 lbs. in excess of my minimum.

As I am not in the dairy business for my health, the questions—"Dairy and Profit," and "How to obtain the milk flow." are problems ever before me. To find out the unprofitable cows is one matter, but to replace them by better is another, and as there are no good cows to be purchased locally, the dairyman must either import or breed. I have chosen the latter course, and in a future number of this Journal I will take up the subject of the "Raising of calves by Dairymen."—Journal *Jamaica Agricultural Society*.

A. H. PINNOCK.

586.—HORSE-MOWING MACHINES.

Not a few people support the view that horse-power machines can be effectively used in the tropics. Among them is A. H. Pinnock, whose article in the *Agricultural Society's Journal* of Jamaica, we reprint in full.

There can be no doubt that there is much to be said in favour of such machines, but at the same time it would not be wise to disregard the light afforded by past experiences of the difficulties which arise during their use.

More than 20 years ago the Buck-eye Mower was introduced into Jamaica for cutting pasture grasses, and was reported successful. A horse rake was also in use.

In Trinidad in 1896 the Manager of the Government Farm introduced a Ransomes Hay Mower and Horse Rake, and an account is given of its working in Agricultural Society's proceedings Vol. II., p. 31. In this paper Mr. Meaden records that one difficulty is that Trinidad is "so far from the manufactory," that it is difficult to get parts replaced when broken, but reports that he cleared pastures with the machines at a very cheap rate.

Recently another machine has been used for the Queen's Park Savannah and appears to be doing good work.

The machine reported on by Mr. A. H. Pinnock is stated to do the work well, and to be an acquisition to Jamaica.

The real test, however, of the value of such machines is to find out how long they continue in use, and not merely what they will do when first imported (*i.e.*) How will they stand the test of time?

There cannot be the least doubt that such machines worked by intelligent labour would be of considerable value, but the difficulty is to get trained labour to meet the situation.

It is not important to go into every detail of the difficulties which are to be met in the introduction of such machinery, but it may be taken as probable, that if left to the genius of ordinary estate hands these machines like many others, will finally retire out of the field of action.

Horse-power Mowing Machines for cutting Guinea Grass.

"If the utility of Horse-Power Mowing Machines for cutting Guinea grass and cleaning commons was better known in Jamaica, I feel sure they would be in general use by our pen-keepers. For the benefit of those who are imbued with the prevailing belief that our rough pastures, full of stumps and stones, will smash up any horse-power mower made in England or America, I will give my experience. About eighteen months ago I selected from various English and American catalogues, a "Deering Ideal One-Horse Mower," (American) with a three feet, six inches cut, which to my judgment appeared to be the machine to suit my requirements. This machine has now cut over one hundred acres of grass and commons without costing a cent for repairs, and I am still using the same pair of knives shipped with the machine, neither of which has lost a single tooth, notwithstanding having been repeatedly jammed with hoop iron, fencing-wire, and other obstacles met with in the process of cutting my pastures. The cost to me landed was £10 10s. With the aid of the book of directions it is easily set up and operated. I found no difficulty, whatever. In my first trials, finding that the machine cut too low and fouled in the thick grass roots, I designed and had fitted a false shoe by means of which the knife is kept three to five inches, as required, above the level of the ground, and since this attachment the machine has been a perfect success. The knives of the "Deering Mower" are so protected that they cannot be injured by stumps or stones, these are of course an inconvenience, and in time ought to be entirely cleared out of the grass pieces where the mower is to be used. When I commenced my grasspieces were full of both, and in consequence much time was wasted in stoppages to get clear of them. With one big horse, or a pair of small mules. I can cut off an acre with my machine in half an hour, and estimating 400 bundles to the acre, at 2s. 6d. per hundred for cutting, I would have been paying 10s. per acre for work, which with the aid of the mower, I can cut and carry in one hour using the permanent day labour men on the property.

In addition to the saving of time and labour in the cutting of grass there is the value of a cleaning of your pastures at each cutting, a perfect cleaning such as it would be impossible to get by hand labour! For cleaning commons this machine is unequalled, and I am sure if better known would be in general use by our Pen-keepers, even for this purpose alone, it cuts through cashaw and other green bush of six months growth or more. Eight to ten acres per day would be a reasonable task for a man and two mules.

To those who import I would offer one word of advice, first master the machine yourself, and, when you have done that, teach the man to take your place, I find my men take to it readily, it is as safe as a dray in the hands of a man who can guide it, but the machine will always require the occasional eye of the master."—Journal *Jamaica Agricultural Society.*

A. H. PINNOCK.

587.—THE USE OF CARBON BISULPHIDE AS AN INSECTICIDE.

The following information and instructions as to the use of carbon bisulphide as an insecticide are reprinted from a pamphlet prepared by Mr. H. H. Cousins, M.A., F.C.S., Government Analytical and Agricultural Chemist, Jamaica, and was published in *Agricultural News* of December 5th, 1900.

We may add that an importation of this material has been made for Tobago, and that it has been tried here in every possible way on the "Bachack" or Parasol Ant, and has been found very effective.

It has also been recently used as an insecticide for Herbarium specimens and books and found to be very effective. To prevent insects returning to the attack in books, it has been found useful to paint the covers inside and out with common turpentine.

In using the material for Parasol Ants care should always be taken to remember that the attack should be made at the highest point of the nest as the vapour or fumes *always fall*, and will not be effective if applied at the lower part. There is not the least occasion moreover, unless one does it for amusement or mystification, to apply fire to explode the vapour as it is quite effective when simply poured into the holes, and the holes closed with earth or other material.

An economic way of using the liquid is to saturate a plug of cotton waste and pass this into any orifice the nest may show.

For borers in Cacao and Coconut trees the application of the liquid is very effective.

Trinidad planters should be grateful to Mr. Cousins for the useful information which he has afforded to the agricultural community.

"*Properties:* Carbon bisulphide is a liquid one-fourth heavier than water (specific gravity, 1·29). One gallon weighs nearly 13 lb. It is very volatile and evaporates rapidly when exposed to the air. It is highly inflammable. Its vapour when mixed with air is liable to explode when ignited. It boils at 115° F. Its vapour is much heavier than air and always tends to flow downwards."

"Its vapour possesses a sweetish smell when perfectly pure. The commercial article always has a more or less objectionable odour. It should not be inhaled in any quantity as it causes dizziness and palpitation of the heart. Fresh air is the best treatment in case of a person becoming affected by the vapours."

SIMPLE RULES FOR SAFE STORAGE AND HANDLING.

"1. Keep it in the special iron drums, or, if in small quantity, in stoppered bottles. See that the stoppers are tight."

"2. Store in a dark, cool place, preferably an outside store, where fire or light will not have access to the liquid."

"3. In pouring out a supply, take care that no flame or even a lighted cigar or pipe of tobacco is near. Arrange to have the vapour as low as possible so as to avoid breathing it."

INSTRUCTIONS FOR USE.

"For the destruction of insects in the soil, root-borers and ants, as well as for sterilizing soil in which seeds or plants liable to injury from insects are to be raised carbon bisulphide is an effectual agent."

"(*a*) *Root-borers*: The liquid itself is destructive to any root brought into contact with it. The vapour, however, in regulated quantity is harmless to roots and highly destructive to insect life in the soil. Hot, dry, sandy soils should only be treated when they have been thoroughly moistened with rain or irrigation water. As a general rule, it is desirable in all cases to use carbon bisulphide when the soil is still damp, since its action is thereby better controlled and regulated. Bore holes at the rate of four per square yard to a depth of 12 inche. No hole should be within 18 inches of the tree trunk. Pour $\frac{1}{4}$ oz. of the liquid down each hole. Special appliances are sold for this purpose enabling two men to make 2,000 injections per diem. For occasional use, the holes should be made with a crowbar and the liquid poured down an iron tube. The earth should be trampled over the hole after treatment. In some cases the holes should slope toward the tree trunk so as to reach insects under the central point.

"(*b.*) *Ants:* When the nest has been located, bore two or more holes to a depth of 1 to 2 feet in the centre of the nest and pour 2 oz. of bisulphide down each hole. Close the hole with earth immediately

"(*c.*) *Borers in trees:* Where the sawdust and castings indicate an active borer at work, inject a little bisulphide with an oil-can into the hole and stop the opening with clay.

"(*d*) *To sterilize soils for seedlings and delicate pot plants:* Place the soil in a suitable box or tin with a close fitting lid. Pour on 1 oz. of bisulphide per bushel of soil: after two days, spread the soil out in the open air. All insect life in the soil will thus have been destroyed. This treatment is found not to injure in any way the fertility of the soil.

"*(e.) To disinfect a granary:* Where large quantities of grain are stored in a building and serious losses through weevils and other insect pests occur, it is a great advantage to treat the whole building with carbon bisulphide. To do this certain obvious precautions are necessary:—

"(1.) The building must be made fairly tight. Ventilators must be papered over and doors made to shut close.

"(2.) Preparations must be made so that a number of men can enter the granary simultaneously, each to pour out in a prepared receptacle the requisite dose of bisulphide and

then immediately to retire. The building should then be kept closed for forty-eight hours and all windows and doors opened for four hours before it is again occupied by men. "(3.) Stringent precautions to preclude any chance of firing the inflammable vapour must be taken.

"For every 25 square feet of floor space supply 1 square foot of evaporating surface (flat tins or dishes).

"Each pan or dish should receive 1 lb. of liquid. The dishes should be placed on level supports 4 feet from the ground. An entire store of grain could thus be freed of insects at one operation extending from Saturday to Monday.

"*(f.) To free grain from insects on a smaller scale:* Carbon bisulphide in the proportions here recommended will destroy insects in grain without affecting the germinating powers of the seeds.

"Every person who stores corn, peas or other grain subject to insect attacks should prepare a fumigating box as follows:—

"Obtain a barrel, puncheon or packing case of suitable size. Line the inside with building paper stuck on with a mixture of varnish and whitening (chalk). Construct a lid which can be fastened down firmly on a bearing coated with felt. For every 50 cubit feet of space in the receptacle employ 1 oz. of bisulphide. For an ordinary flour barrel one teaspoonful ($\frac{1}{8}$ oz.) of bisulphide should suffice, if the receptacle be tight and free from leaks.

"Place the bisulphide in a saucer on the surface of the grain, keep tightly closed for thirty-six hours."

"(*g.*) *Clothes Moths:* Great damage to clothes is done in the tropics by various species of moths. Camphor and naphthaline or pyrethrum insect powder tend to keep the adult insects away, but the former, at any rate, have no effect on the larvae when they have once commenced their attack on the clothing."

"Before putting clothing, woollens, or furs into store it is advisable to treat them with carbon bisulphide. An ordinary tin trunk can be used if newspapers are spread over the top and the lid kept tightly closed. Pour half a wine glass-full of the liquid on the surface of the clothing, spread the papers quickly and shut tight. Should the box be opened at intervals afterwards, naphthaline balls or insect powder serve to keep away a fresh infection. The liquid will not injure the clothing or leave any stain."

"(*h*) *Household Insects:* Should it be desired to destroy cockroaches, bed bugs or fleas in a house, it should be treated on the lines laid down for disinfecting a granary."

"A suitable time for this treatment would be an occasion when the house is to be shut up for three or four days or longer. Individual rooms could be treated, if desirable. Stringent precautions to avoid ignition of the vapours or their inhalation by human beings are of course necessary."

"(*i*) *Insects in Tobacco, Museum specimens and Books:* These can be readily destroyed by treatment in a suitable closed vessel with

carbon bisulphide. If the receptacle be tight, 1 oz. of bisulphide will suffice for each 50 cubic feet of space. The treatment should last for thirty-six hours."

AUTHORITIES UTILIZED.

"*Carbon Bisulphide as an insecticide:* W. E. Hinds."
Farmers' Bulletin 145, U.S.A. Dept. of Agriculture.
"*Insects affecting Tobacco:* L. O. Howard."
Farmers' Bulletin 120, U.S.A. Dept. of Agriculture.
"*Household Insects of U.S.A.:* F. H. Chillenden."
"*Chemistry of the Garden:* H. H. Cousins. Macmillan & Co., Ltd."

588.—GARCIA NUTANS, *Rohr.*

Several fine trees of this Euphorbiaceous plant are growing in the Gardens. Seed recently examined in Europe have been found to contain a strong purgative, resembling that which forms the active principle in *Ricinus* which affords the castor oil of commerce.

589.—AS OTHERS SEE US.

Herr Bernh. Othmer, Curator of the Botanic Gardens of Munich, Bavaria, is visiting Trinidad on a short Botanical Tour, and is collecting specimens of the Island flora in the several districts. He has already visited Toucouche, the Aripo Savannah, the woodlands of Valencia, &c., and expresses his delight at the luxuriant character of the vegetation. One of his first remarks on entering the precincts of the Botanic Gardens was devoted to what he called the "glorious" character of the Epiphytical vegetation on the trees of the Garden. Local opinion, probably from its constant familiarity with these forms of vegetable life, does not set so high a value upon them as the visitor, but it is certain they form one of the most interesting features of the Island flora, and are much admired by all scientific men connected with Botanical Science.

Professor D. G. Fairchild, who as an Agricultural Explorer has been round the world with the expedition of Mr. Lathrop, and has seen all the West Indian establishments, writes as follows in the *Bulletin* of Plant Industry, No. 27 :—

> "The most fully equipped Botanical Garden, and the most
> "profitable place in the West Indies for American students
> "who wish to learn the elements of Tropical Agriculture
> "is here in Trinidad where a comfortable Laboratory, and
> "an unusually rich economic Botanic Garden * * *
> "would enable a young American to pursue any line of
> "research relating to the culture of tropical plants."

This must be considered a high compliment to the Trinidad Botanical Establishment, as it is written by a man who has practically seen all the Botanical Services of the world during the past three years, and it is here produced as a permanent record of the state of the Establishment at the present date, and that residents may have the satisfaction of knowing the opinion of qualified experts on the Botanical Department as maintained by the Trinidad Government.

590.—WHAT IS THE BOURBON CANE?

Many people will probably be surprised at this question, as probably few will be ready to admit that there is any doubt on the matter.

During the experiments in raising seedling canes at St. Clair however: we took for a standard a sample of "Bourbon," plants of which were selected and presented to the Department by the late Mr. J. S. Wilson of Aranguez estate. For several years the analysis of this cane showed results below that of the regular yield of Bourbon canes on estates in other parts of the Island, and it was therefore considered questionable whether there was complete identity between the "Bourbon" as grown on different estates or not.

With a view of testing this point I secured plants of the "Bourbon" grown on one of the Colonial Company's estates, through the kindness of P. Abel, Esq., the Attorney of the Company.

The difference between the appearance of the two canes, and the results of their analysis is equally striking. In the former the colour of the cane is essentially distinct, the Colonial Company's cane being a much brighter and cleaner yellow than the Aranguez cane. The habit, weight per acre and yield of sugar are also strongly in contrast.

The analytical results are briefly as follows:—

"Bourbon."	per cent. Sucrose.	per cent. Glucose.	lbs. per gallon Sucrose.	lbs. per gallon Glucose.	Estimated sugar, tons per acre.	Specific gravity.	
Colonial Company's cane	17·14	1·25	1·849	·125	3·15	1078	Season May 1903.
Aranguez ...	15·45	1·40	1·656	·140	·38	1072	
Caledonian Queen ...	18·09	0·50	1·953	·050	4·11	1079	

In previous years the result of the Aranguez yield was similar, but the estimated yield of sugar for 1903, must not be taken to be an accurate one for this variety as it happens to be based upon the returns of an experimental plot, planted in a particular manner, which allowed one cane to take advantage of another. Caledonian Queen and Bourbon were planted in alternate rows, a suggestion of an experienced planter: the result being, that the former overgrew the latter. The result is seen in the fact that while the Caledonian is over-average, as to weight per acre, the Bourbon is much under average. The Caledonian Queen practically overgrew and robbed the Bourbon of its nutriment to such a degree that I estimate the area on which the calculations should have been based, should have been increased by $\frac{1}{40}$th and the area upon which the Bourbon was grown, decreased by the same amount (*i.e.*) Although on the field $\frac{1}{20}$th of each cane was planted, yet in reality the ground occupied by each was, Caledonian Queen $\frac{1}{20}$ths, Bourbon $\frac{1}{40}$th, an adjustment which will make a considerable difference in the estimate of value of the canes as shown in the analytical returns The Caledonian Queen gave a yield side by side with the Bourbon as seen in table

Our present question, however, relates more to the Bourbon individually. What is it?

Now, our experiment appears to show that we have secured in what are known as "Bourbon" canes, *two distinct varieties*. If this is so, a further question may well be asked; Are these canes merely varieties of the one kind or have they had an independent origin?

Personally I am of opinion that there is not only one, but dozens of different kinds of the so-called "Bourbon" canes; which *hypothesis* would appear to explain the variable results obtained by different Estates.

As a matter of fact almost any yellow cane unless it has some specially marked distinctive feature is called a Bourbon on estates, and on our experiment plots. I have frequently heard seedlings called "Bourbon" which I know to have originated from varieties quite distinct from the Bourbon and therefore not of the same family, or blood relationship at all.

Such a mixture of different varieties as this, if it exists, (?) and I have the opinion of one of our best planters with whom I have discussed the matter, that it does; cannot be for the good of the industry. This gentleman says—"*The extremes of readings for the two Bourbons may be taken to prove what I have always said—that variations in that cane are as great as any observed between it and other varieties.*"

Now as the Bourbon has always been taken as a standard in cane experiments the question arises what "Bourbon" has been used? Is it the same or different to that used in other colonies. If not, the results of two places working with a different standard would not be easy of comparison. The question however appears to offer a means for simple solution. Let specimens of the so-called Bourbon on each estate be sent to a central station and grown in plots side by side. The best kind of "Bourbon" could then easily be selected, and a standard fixed upon which should be common to all experiment stations to their considerable benefit.

Again it may be possible, and I consider probable that there may be "Bourbon's" which are disease resisting canes, as well as Bourbon's that easily succumb to Fungi: and this might also be proved at the same time.

Further, there may be "Bourbons" that produce fertile seed, as well as some that are infertile, a possibility which would explain the power to raise seedlings in one place and not in another. If one kind could be found of high quality, which could readily be reproduced from seed, it appears clear, that the chances of getting improved canes would be greater, coming from the long acknowledged *best* of the cane tribe, than from canes whose claim to public favour are not in any way so prominently put forward.

This article commenced with a question, what is the Bourbon Cane? We have not answered it, nor did we set out to answer it, but merely write to raise a working hypothesis which may give a solution to a question which, when carefully looked at, appears to be of considerable importance to the sugar interest.

591.—PRUSSIC ACID IN CASSAVA ROOTS.

It has been recently ascertained that the poisonous principle in *Prunus amygdalus*, *Lotus arabicus*, and *Sorghum vulgare*, is due to the formation of H C N or Prussic acid as the result of the decomposition of a *glucoside* by an *enzyme*, or inorganised ferment, in the presence of water.*

Several published analyses of the Cassava root appear to show that prussic acid is obtainable by allowing the sliced material to rest in the presence of water for some hours, and that fresh amounts of poison can be extracted several times in succession. It is therefore possible that the primary poison content is largely added to by rapid decomposition, when the material is allowed to rest in the presence of water. As yet, however, we do not appear to be in possession of the exact amount of poison the roots originally contain, for in the laboratory processes, the method has been to extract with water, causing a "cyanogenetic" process to be set up, which actually appears to generate the acid.

As additional evidence that the poison is so generated, we have the well-known fact, that cooked cassava after standing a few hours, becomes poisonous: and many cases of poisoning have been attributed to this cause.

The material of the Cassava root grated and dried, which becomes damp by the absorption of moisture from the atmosphere, has also been found on analysis to contain Prussic acid, although when in a perfectly dried state and freshly made, it was quite free from poison.

It appears therefore to be highly important that the initial, primary or original amount of poison contained in the root should be carefully ascertained, as this point is clearly seen to be of far greater importance, than it is to ascertain the primary contents including the quantities which can be developed as a decomposition product. That there is a primary poison content is shewn by deaths which occur from eating fresh roots of the bitter cassava.

Following the matter up, it appears desirable to ascertain as follows:—

How much H C N or Prussic acid does the root of (1) Bitter Cassava, and (2) Sweet Cassava contain?

1. In the entire fresh root?
2. When skin is removed?
3. In the skin of the root?
4. In the root without the skin?
5. In the juice expressed from the whole root?
6. In the material left after expressing the juice?
7. In expressed juice kept twenty-four hours?
8. In the clean starch of bitter cassava left in the presence of water 12 and 24 hours?

By ascertaining the above we should be better informed as to the actual poison content of Cassava roots, in the state in which it is actually used as food.

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* Bulletin, No. 3, Imperial Institute.

Assuming that the production of H C N in the presence of water actually takes place in Cassava as in the plants mentioned, we have yet to ascertain the name and character of the *glucoside* and *enzyme* which causes the change.

It is highly probable, however, that the public will shortly be better informed, as work on this subject is in progress under able direction.

592.—COTTON.

By direction of the Government, arrangements have been made to secure Cotton seed for the coming planting season.

Two hand gins have been imported and a suitable baling press is under order. The Secretary of State has informed His Excellency the Governor that the Cotton Growers' Association has agreed to handle all cotton consigned to their care free of charge except for brokerage.

One of the gins has been put into working order at St. Clair.

A working committee has been appointed to assist the authorities.

A pamphlet giving full information on the Cotton Industry will shortly be issued.

593.—BANANAS.

A pamphlet giving information to Banana planters has been prepared and it is hoped will be issued shortly.

The new varieties at St. Clair which were introduced from the East Indies *viâ* the Dominica Botanic Station have commenced to fruit. The first bunch is mature and turns out to be something quite different to any hitherto grown in the Colony. It came to us under the name of *Musa discolor*.

594.—A CURIOUS LIZARD.

During the month of December I found on the road a small animal which I at first took to be an earth worm. Closer examination showed it to be a small lizard with minute legs, which are evidently of little use to it for progression purposes as it was adopting the curling and jumping of the common earth worm. Mr. R. R. Mole who has made a particular study of this class of animals informs me that it is rare in Trinidad, but that he took specimens to England in 1897, which were found on the lands of the Botanical Department. At the British museum Mr. Mole informs me these specimens were determined as *Scolecosaurus Curierii*, and de Verteuil in his history of the Island makes mention of the animal. On showing it to one of our nursery hands he stated that he had frequently seen them in leaf mould. Not knowing on what to feed it, I had some well rotten leaf mould brought in and placed the animal on the surface. In the space of 10 seconds, it buried itself completely in the earth, with a motion very similar to that of earth worms, in which the minute legs appeared to be of little service. Our specimen Mr. Mole thinks is about one-

third grown. It is some $4\frac{1}{2}$ inches in length and about $\frac{1}{8}$th to $\frac{3}{16}$ths of an inch in diameter of body, the tail, which slightly tapers, forming half its length. The head is spear-shaped and well calculated for burrowing purposes. At times it has the movement of a snake, which possibly accounts for its name of Vipère, which is used for it by natives of the Colony. It is a very curious little animal and evidently stands intermediate between snakes and lizards clearly showing by the disuse of its legs, a process of evolution which will probably result in their eventual disappearance.

595.—GRAPE CULTURE IN NAPARIMA.

Mr. W. Alfred Herbert has sent us the following :—

It may interest you and also the readers of your widely circulated Bulletin to hear something of a grape cutting concerning which, on the 13th October, 1902, in reply to my letter of enquiry, you thus candidly wrote in reply to my question, whether a vine would bear if taken from another plant before the original had produced fruit. "With regard to the question you ask, I can only say that it is one "of the absurd and ignorant conceptions which are met with among "those inconversant with plant life. I have raised hundreds of grape "vines from vines which have never borne a fruit. There is no prin-"ciple in vegetable life to prevent a plant bearing fruit because its "forefathers were not in a position to do so. In some cases, however, "vines are known not to possess the male and female organs in the "one plant, and then it would bear no fruit unless pollen was obtained "elsewhere." Upon the receipt of the above encouraging information my determination to try my hand at grape culture because I was persuaded that the "absurd and ignorant conceptions" I had previously been treated to, were erroneous and that my efforts would be abortive no longer. I set about planting my young vine which had for sometime been growing in a pitch oil tin, in its permanent position. It was then 8 feet in height. The soil had been specially prepared on the principle that it should not be too compact or porous, rather loose, being more rich than sterile. It was kept well moist with a nourishing fluid corresponding somewhat with the chemical composition of the vine and its fruit. It is to this preparation of the soil, its care and attention that I must attribute the success which almost immediately followed upon transplanting the vine into Mother Earth. In the month of February, 1903, when the vine was but six months old, it had already covered an overhead area of 154 square feet, and one fine morning the bursting of fruit buds was observed. The blossoms "held" and a few weeks later we had the pleasure of reaping two bunches of purple grapes. As the branches grew older, the vine continued to spread rapidly, so much so that I found it necessary to erect a substantial arbour 34 feet by 14 feet to accommodate it. My partner in life, seeing that the available trellis had nearly all been covered, suggested to me to give the vine a light pruning. I was somewhat sceptical of the results of inflicting wounds on so young a vine that had not yet attained the age of a single summer; however, after persistent urging, I applied the pruning knife moderately. The effect was, indeed, marvellous. Some weeks after, side shoots from the principal branches made their appearance in

quantity, and were soon followed by blossoms, and as the days and weeks passed on, it became more and more evident that Dame Nature in her bountiful goodness had decreed a rich and plentiful harvest. During September and October, several gentlemen to whom I related my success, treated it as a huge joke, "it is an unheard of thing" remarked one, "I know a friend who has a vine these three years and it shows no signs of fruit" said another. On this I asked my friends to come and see it and my invitation was accepted when it was found to be bearing 127 bunches of fruit, all hanging in full view. My friend suggested that the spectacle was so unique that I might photograph the vine as it then appeared. About 75 per cent. of the crop weighed from 16 to 20 ounces per bunch, and I estimate that quite 110 lbs. of fruit were realized. At the rate of 50 cents a pound, my vines product valued £11 9 2 and I am looking forward confidently to a June crop. Several persons advised me that to improve the size of the grapes I should reduce the number of berries the bunches contained when quite young. If it will be of any interest to you I will take pleasure in advising you of future results.

596.—REPORT ON SAMPLES OF CASTILLOA AND FUNTUMIA RUBBER FROM TRINIDAD.

By Professor Wyndham R. Dunstan, M.A., F.R.S., Director.

The samples of rubber were prepared in connection with the experimental cultivation of various rubber-yielding trees in Trinidad and were forwarded to the Scientific and Technical Department of the Imperial Institute chiefly with the object of ascertaining by chemical investigation supplemented by commercial valuation the influence of the age of the tree on the quality of the rubber it furnishes and also by the same means to determine the effect of the method of coagulation employed on the quality of the rubber furnished by the latex.

I.—Two Samples of Castilloa Rubber.

Two small samples of rubber prepared respectively from old and young trees of *Castilloa elastica* were forwarded to the Imperial Institute for comparative chemical examination by the Superintendent of the Royal Botanic Gardens, Trinidad. In the accompanying letter, dated June 2nd, 1902, Mr. Hart stated that the rubber had been prepared from the latex by creaming and draining, and pointed out that in physical properties the rubber derived from young trees was much inferior to that yielded by the older trees of the same species.

1.—Rubber from young trees (4 years old.)

The specimen showed very little resemblance to true rubber and was evidently highly resinous. It was almost black, rather hard in the lump but could be moulded by pressure and was easily indented with the finger nail: small fragments were soft and sticky. It exhibited very little tenacity and no elasticity.

2.—Rubber from old trees.

This was a specimen of good rubber, almost black, only slightly sticky, very elastic and exhibiting considerable tenacity.

A chemical examination of each of the two specimens gave the following results :—

	Moisture.	Caoutchouc.	Resin.	Dirt.	Ash included in dirt.
Rubber from young trees (4 yrs. old)	0·54	33·6	64·1	1·7	0·35
Rubber from old trees ...	0·41	81·9	15·8	1·9	0·34

The purified caoutchouc from the rubber of the young trees was very soft and sticky, whereas that furnished by the rubber from the older trees exhibited very satisfactory physical properties.

These analyses amply confirm the opinion based upon the appearance of the samples and prove that the rubber prepared from the latex of the young trees of *Castilloa elastica* is a very inferior product, consisting largely of resin. The results agree with previous analyses recorded by different investigators who have invariably found that the amount of resin in the latex of *Castilloa elastica* is very large in the young trees but gradually diminishes with age, until after the eighth year or so the tree yields rubber of good quality. Practical experiments in the cultivation of *Castilloa elastica* fully support this conclusion. The age of the "old trees" under notice was not stated but the amount of resin present in the rubber, viz : 15·8 per cent., is much greater than is permissible in rubber of good quality.

II.—Two samples of funtumia rubber.

Two small samples of rubber derived respectively from *Funtumia africana* and *Funtumia elastica* under cultivation in Trinidad were forwarded to the Imperial Institute by the Superintendent of the Royal Botanic Gardens at the instance of the Government of Trinidad. In his letter, dated July 29th, 1902, Mr. Hart stated that the specimens were obtained from seedlings of the two species, three years old and with stems about 3 inches in diameter, and that the latex was coagulated by the addition of alcohol. It was also mentioned that according to reports from West Africa, *Funtumia africana* produces rubber of inferior quality whereas *Funtumia elastica* yields an excellent product, and it was therefore desired to ascertain whether this would be the case when the plants were grown in Trinidad. The physical character of the two specimens certainly tended to support the view that there is a great difference in the quality of the rubber yielded by the two species.

(1.) Rubber from Funtumia africana, Stapf.

The specimen was forwarded between watch glasses. It was a very soft, sticky mass which adhered to the fingers and pulled out in long fine threads; it had a brownish colour externally but was whitish within.

(2.) Rubber from Funtumia elastica, Stapf.

This was a small piece of soft and sticky rubber of dark brown colour; it exhibited good elasticity and fair tenacity. It was much superior in physical characters to the preceding specimen.

The following results were obtained on analysis :—

CALCULATED ON THE DRY MATERIAL FOR COMPARISON.

	Moisture.	Caoutchouc	Resin.	Dirt.
(1.) Funtumia africana	20·7	39·3	60·0	0·7
(2.) Funtumia elastica	15·1	80·4	15·3	4·3

It will be seen from these figures that the sample of rubber from *Funtumia africana* is greatly inferior to that from *Funtumia elastica*

containing nearly four times as much resin and only half as much caoutchouc as the latter. As the trees of both species were of the same age this difference in the product would appear to be characteristic, but before this conclusion can be entirely accepted it will be necessary to examine larger specimens of the rubber derived from older plants and it is desirable that these specimens should be obtained.

III.—Samples of Castilloa and Funtumia rubbers.

These samples of Castilloa and Funtumia rubber, prepared by the Superintendent of the Royal Botanic Gardens, were forwarded to the Imperial Institute for chemical examination and commercial valuation by the Government of Trinidad and are referred to in a letter from the Colonial Secretary, No. 995/03/304. dated February 13th, 1903. Full particulars regarding the collection and preparation of the specimens were furnished in a letter from Mr. Hart dated February, 12th 1903.

Seven samples of rubber, five of Castilloa and two of Funtumia, were submitted for examination. These had been prepared by different methods and in the case of the Castilloa rubber from trees of different age. In addition two specimens of the entire latex of Castilloa, to which 'Chloretone' had been added as a preservative, and three specimens of the mother liquor of the Castilloa latex after removal of the rubber, were forwarded.

The samples of the entire latex had been forwarded in connection with an enquiry in progress in the Scientific and Technical Department of the Imperial Institute but unfortunately the 'chloretone' did not suffice to preserve them and they had completely coagulated during transit. The mother liquor of the latex from which the rubber had been separated is a dark coloured liquid which is stated to yield on evaporation "a hard black sticky substance, intensely bitter, resembling in appearance Bitter Aloes." The constituents of this mother liquor have been reserved for future investigation.

The present report deals exclusively therefore with the seven specimens of rubber and, for convenience or reference, the particulars furnished by Mr. Hart are quoted in connection with the description of each sample.

Description of the Samples.—No. 2 Funtumia.

"350 c.c. Funtumia latex from trees $4\frac{1}{2}$ years old. This was coagulated with a sufficient quantity of alcohol added gradually and produced 270 grams of wet rubber. 'Wet rubber' is rubber just after coagulation. It drains considerably afterwards and probably loses 15 to 20 per cent. in weight."

The specimen consisted of two pieces of rubber each approximately $4'' \times 3'' \times 1''$, and together weighing 240 grams. On arrival they were a light brown colour externally but darkened considerably on keeping: when cut they were slightly porous and quite moist within but contained no uncoagulated latex: the colour of the freshly cut surface was a light cinnamon brown and only a trace of foreign matter was present. The rubber was soft and slightly sticky, very elastic but rather deficient in tenacity.

No. 3. Castilloa.

"350 c. c. Castilloa latex from trees 4½ years old. Added 150 c. c. alcohol. After coagulation and draining the rubber blackened quickly. Obtained 140 grams of wet rubber."

The specimen consisted of a single piece about 4 inches by 2 inches by 1 inch weighing 95 grams, and was evidently of very inferior quality. The mass was very hard but could be indented with the finger nail and its shape alter by compression: it was almost black externally but dark brown within and small fragments of bark were distributed through it. Small pieces of the material were soft and exhibited only slight elasticity and very little tenacity.

No. 4. Castilloa.

"350 c. c. of Castilloa latex from trees 4½ years old. Added two litres of water and set to cream for 12 hours. Coagulated with alcohol and obtained 118 grams of wet rubber. This appears brittle. Creamed rubber is always cleaner and whiter than rubber from latex coagulated as gathered. It appears to wash away much proteid matter."

This was very similar to the preceding sample, No. 3, in appearance and characters but was a little softer and more elastic. It was a single piece about 5 inches by 2 inches by 1 inch weighing 85 grams, which was dark brown externally but much lighter within, the freshly cut surface having a glossy appearance.

No. 5.—Funtumia.

"50 c. c. of latex of *Funtumia elastica* from trees 4½ years old. Coagulated with heat over lamp. Obtained 42·8 grams of rubber."

The specimen was a small ball of rubber weighing 39 grams. It was of a light brown colour externally but darkened on keeping: within it was quite white, porous, and contained a considerable quantity of uncoagulated latex. The ball was therefore cut into slices and allowed to dry in the air before analysis. The rubber exhibited satisfactory physical character: it was rather soft but very elastic and tenacious and only slightly sticky.

No. 7.—Castilloa.

"500 c.c. Castilloa latex from trees 4½ years old. Poured direct on copper mesh (fine wire) and allowed to drain. Rubber coagulated by air naturally in 48 hours. Was taken off wire and doubled up."

The specimen consisted of a sheet of black rubber, about 12 inches square and ⅛ inch thick, which was slightly mouldy on the surface. It was of very inferior quality, being only slightly elastic and exhibiting very little tenacity.

No. 9.—Castilloa.

"600 c.c. of Castilloa latex from trees over 12 years old. Added alcohol to coagulate. Coagulation appeared imperfect. To be compared with No. 3, old and young."

This specimen consisted of a single piece of black rubber weighing 200 grams. When cut open it was found to be very porous and contained a considerable quantity of acid liquid: it was therefore cut into slices and air-dried before analysis. It also contained numerous frag-

ments of bark and wood of rather large size which on removal were found to amount to 4·6 per cent. of the total weight. The rubber was very elastic and tenacious, and only slightly sticky.

No. 12.—Castilloa.

"Specimen of rubber made from washed and creamed latex of trees 12 years old and over. Coagulated with alcohol. This appears to be the best specimen of Castilloa sent."

The sample was a small piece of black rubber weighing 27 grams; internally it was a dark greyish colour throughout, dry, and quite free from foreign matter. The physical characters of the rubber were very satisfactory: it exhibited considerable elasticity and tenacity, and was not sticky. In appearance and characters it was certainly the best specimen of Castilloa rubber submitted.

Chemical Examination.

The following results were obtained on analysis of the various samples:—

SAMPLES AS RECEIVED.

No.	Variety of rubber.	Age of trees.	Moisture.	Caoutchouc.	Resin.	Dirt.	Ash included in dirt.
		years.	per cent.	per cent.	per cent.	per cent	per cent.
2	Funtumia ...	4½	29·5	60·2	7·9	2·4	1·37
5	Funtumia ...	4½	21·2*	68·5	7·9	2·4	2·08
3	Castilloa ...	4½	10·3	37·1	47·1	5·5	1·47
4	,,	4½	4·3	41·1	53·8	0·8	0·31
7	,, ...	4½	8·0	40·8	45·4	5·8	1·24
9	,, ...	over 12	15·2*	70·1	11·7	3.0†	0·79
12	,, ...	12 and over	2·2	89·1	8·2	0·5	0·25

CALCULATED FOR DRY MATERIAL.

2	Funtumia ..	4½	...	85·3	11·2	3·5	1·94
5	Funtumia ...	4½	...	86·9	10·0	3·1	2·66
3	Castilloa ...	4½	...	41·3	52·6	6·1	1·64
4	,, ...	4½	...	43·0	56·2	0·8	0·32
7	,, ...	4½	...	44·4	49·3	6·3	1·34
9	,, ...	over 12	...	82·7	13·8	3·5†	0·93
12	,,	12 and over	...	91·2	8·3	0·5	0·25

It will be seen from these figures that the three specimens of Castilloa rubber, Nos. 3, 4, and 7, which were obtained from trees 4½ years old, contain very large amounts of resin, viz: 52·6, 56·2 and 49·3 per cent. respectively on the dry material, and they would therefore possess little value as rubbers. The results of the chemical examination confirm the opinion based upon the physical characters of the specimens and it is clear from these results that Castilloa trees 4½ years old will not yield a marketable rubber. This conclusion agrees with that arrived at by previous investigators but it must be remarked that the amount of resin present in the specimens under notice, and also in the

* These specimens were air-dried before analysis.

† Exclusive of 4·6 per cent. of bark removed before analysis.

small sample of Castilloa rubber from a tree four years old which is dealt with in Part I of this report, is considerably greater than has been hitherto recorded for Castilloa rubber obtained from trees of the same age growing in other countries. Thus Weber in some experiments conducted at Las Cascadas on the Isthmus of Columbia found that the rubber obtained from the trees of *Castilloa elastica* 4 and 5 years old contained 26·47 and 18·18 per cent of resin respectively, which is about half the amount found in the present case. The much higher percentages of resin found in the specimens from Trinidad may possibly be due to differences of climate, soil, &c. The different methods of preparation followed in the three cases has not influenced the composition of the rubber to any appreciable extent, the only striking difference being that No. 4, which was prepared by creaming, contained very little foreign matter and ash as compared with the other two specimens.

The two samples of Castilloa rubber, Nos. 9 and 12, which were obtained from trees 12 years old and upwards, were of much better quality than the preceding, though the amount of resin present, 13·8 and 8·3 per cent., is still higher than is usually found in the best qualities of this variety of rubber. Specimen No. 12 is the best of the series both as regards chemical composition and physical characters.

Both specimens of Funtumia rubber, Nos. 2 and 5, are presumed to have been obtained from *Funtumia elastica* though this is only stated definitely of No. 5. The samples were derived from trees of the same age, viz: 4½ years, the only difference being in the method of coagulation employed; in chemical composition they were very similar. The rubber was rather soft but was of very fair quality, the amount of resin present in the dry material being 11·2 and 10·0 per cent. respectively. Both samples were very wet when received and No. 5, which had been prepared by heating, contained a considerable quantity of uncoagulated latex This defect could, however, be easily remedied in which case the market value of the rubber would probably be increased.

It appears from these experiments that the trees of *Funtumia elastica* under cultivation in Trinidad will yield a marketable rubber at the age of 4½ years, whereas the product obtained from *Castilloa elastica* trees of the same age would possess little commercial value.

COMMERCIAL VALUATION.

Samples of the four rubbers suitable for commercial valuation, viz: the two Funtumia rubbers, Nos. 2 and 5, and the two Castilloa rubbers, Nos. 9 and 12, were submitted to brokers who were informed of the results which had been obtained by chemical examination. The brokers report that at the present time the rubbers would have the following values in the London market:—

No. 2 Funtumia	2/6 per pound.
No. 5 ,, ...	2/2 ,,
No. 9 Castilloa	2/4 ,,
No. 12 ,, ...	2/9 ,,

They observe that there has recently been a considerable scarcity of medium qualities of rubber in the London market and that consignments of similar quality to these samples would command a ready sale at the present time.

The results furnished by the examination of the various samples of Castilloa and Funtumia rubber so carefully and systematically collected and prepared by Mr. Hart are of considerable scientific interest and are of obvious practical importance, especially in establishing the conditions which must be secured in order to produce rubber of first rate quality.

IV.—Sample of Castilloa rubber prepared by Weber's method.

This sample of rubber of *Castilloa elastica* was forwarded to the Imperial Institute by the Government of Trinidad and is referred to in a letter from the Colonial Secretary, No. $\frac{2\,8\,4\,7}{1\,9\,0\,3}$ dated May 8th, 1903. The rubber had been prepared by the Superintendent of the Botanic Department according to the method suggested by Dr. C. O. Weber, which consists in the addition of formaldehyde to the creamed latex. The following particulars were supplied regarding the exact procedure adopted :—

"Latex from Castilloa trees 14 to 16 years old, 500 c.c. creamed in four times its volume of clean water, three times in succession to remove albuminoids. Added 20 c c. of commercial formalin to latex when creamed on last lot of water. No cohesion took place until 96 hours after mixing. Rubber then lifted and pressed. Cold water was used."

The specimen was a semicircular cake, 4 inches in diameter and 1 inch in thickness, which weighed about 50 grams. Externally it was a light brown colour but within it was quite white, perfectly dry and free from foreign matter. The rubber exhibited very satisfactory physical properties ; it was not sticky and was very elastic and tenacious.

The following results were obtained on chemical examination :—

	Samples as received.	Calculated for dry material.
Moisture per cent. ...	9·5	—
Caoutchouc ,, ...	82·6	91·2
Resin ,, ...	7·4	8·2
Dirt	0·5	0·6
Ash (included in dirt) ...	0·26	0·29

These figures are practically identical with those furnished by sample No. 12 of the previous consignment, which was prepared by coagulating the wash and creamed latex by alcohol. The physical characters of the two specimens were also very similar, the only difference being that the samples prepared by Weber's method was much lighter in colour.

The brokers also regarded the two specimens as of equal value and quoted for each a price of 2s. 9d. per pound.

WYNDHAM R. DUNSTAN.

10th November, 1903.

TRINIDAD. No. 42.

BOTANICAL DEPARTMENT.

BULLETIN

OF

Miscellaneous Information.

(QUARTERLY.)

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Edited by the Supt. Botanical Department:

J. H. HART, F.L.S.

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597.—ALBIZZIA LEBBEK, *Benth.*

THIS tree, though so common in the Island of Jamaica, is one which does not thrive under cultivation in Trinidad; for even with the greatest care it can hardly be kept alive.

This fact is strong evidence that there exists a decided difference in climate between the two Islands.

That the difference is not one of temperature merely, is shown by the fact that the mean annual and daily readings at the two places differ but slightly; the mean annual, by half a degree only, at similar elevations.

From observations during a series of years it would appear that the failure of Albizzia Lebbek in Trinidad, is due probably to the greater humidity which exists in the latter place, and possibly to a deficiency of calcareous matter in the soil. The Saman—*Pithecolobium Saman. Benth.*, is a tree which flourishes in Jamaica side by side with the *Albizzia*, and does equally well, if not better in Trinidad.

We have here, therefore, a case which is interesting as to the why and wherefore, of the different growth shown by two *Leguminous* trees of similar habit and nearly related botanically to each other. In Trinidad and also Jamaica there is strong evidence that the "Saman," ("Guango" of Jamaica) is an imported tree, while the Albizzia is indigenous to Jamaica but imported to Trinidad.

The Albizzia is known as "*Woman's tongue*" in Jamaica, so called it is said on account of the noise made by the chartaceous legumes when shaken by the wind. That is to say, it is a direct libel on the ladies, for the pods are always making a noise.

598.—YAMS: ÆRIAL TUBERS.

THE usual method of planting yams in the West Indies is by large cuttings of the tubers called "Yam Heads." This part is the upper hard unedible portion of the tubers which is practically useless for the table. It is difficult, however, with some varieties to get enough for planting increased areas.

Most varieties of the White Yam, or, *Dioscorea alata, var.*, produce ærial tubers, and these we find may be successfully used for producing crops. They do not give so large a return per plant as when grown from "yam heads." but are especially useful for extending cultivation and give a return of good useful tubers fit for the table.

There is another advantage in using the ærial tubers which is not to be overlooked; and this lies in the fact that they produce clean healthy tubers, but when "yam heads" are used, any disease they may have is almost sure to be communicated to successive crops.

Yellow and Negro Yam heads are offered in Jamaica by the Agricultural Society at 9/- per cwt. for planting; White Yam at 11/- per cwt.

Address: Secretary, 4, Port Royal Street, Kingston, Jamaica.

599.—THE INFLUENCE OF ENVIRONMENT.

A special instance of the influence of environment in the growth of plants has recently been observed.

For a series of years observations have been made on the growth of *Omphalea, megacarpa, Hemsly.* In the native forest this plant is found as a climber covering trees to the height of 70 or 80 feet, and not flowering or fruiting until it reaches their topmost branches. Seed was obtained and trees were planted in an open sunny spot where there was nothing for the plant to climb upon. For several years it threw out long trailing branches with the evident intention of "going away" upwards. For the last two years, however, its growth has been vigorous, but less of the climbing habit was visible and flowers were produced in 1903 succeeded by two fruits, and in 1904, by several fruits.

A similar instance was formerly observed in a plant known as *Roupellia grata.* Of this we have also plants 3 feet high in flower in the open, while in one planted near a tree, it has grown fully sixty feet high and flowered in the topmost branches of its host.

600.—ANIBA MEGACARPA, *Hemsley, n. sp.*

In Hooker's Icones Plantarum, Vol. 4, part 3, of November, 1903, is published a description by W. Botting Hemsley, Esqre., of a species of *Laurineae*, which is new to the West Indian flora. Its discovery was first recorded in Bulletin, Vol. 4, p. 403, 1901. Fruits, however, were sent on to Kew in 1900, and again in 1901, with flowers, and drawings of the flower. It was brought in by a native collector from the districts of Guapo and Tabaquite. It is there known as "Laurier Matac," and is said to be a good hard wood timber, the trees growing to 60 feet in height. Seeds were procured and sown and three plants are now growing at the Experiment Station. The fruit is in appearance much like a huge acorn, and over three inches in length. It stands in the Trinidad Herbarium as No. 6786. It is so far unique in West Indian collections.

601.—JAMAICA PRIZES FOR SMALL HOLDINGS.

The Journal of the *Jamaica Agricultural Society* for February, 1904, contains a very interesting report by Mr. Cradwick, travelling Agricultural Instructor, which was read at a meeting of the Society held 28th January, 1904.

As the report is held by the Society for future consideration it would be premature to discuss its points, but it is reproduced in full for the benefit of readers of the Bulletin.

Sir,

I beg to submit the following report on the Prize Holdings Competition in the Parish of Westmoreland :—

"Assisted by the Rev. E. Arnett I visited and examined 92 Holdings. We awarded the fifteen prizes offered by the Jamaica

Agricultural Society and recommended that the entry fees amounting to four pounds twelve shillings be distributed as special prizes, which I am happy to say, was done. I am pleased to be able to speak in terms of the highest praise of the Prize Holdings in Westmoreland, the prize-winners in the first class were exceptionally creditable. The first prize-winner in the second class also deserves high commendation—the improvement in his holding made by him since the inauguration of the scheme is deserving of the highest praise. The clearing up which this worthy competitor gave his holding in his endeavour to win a prize, was most complete. Permanent crops were cleaned and pruned, shade trees lightened in accordance with my suggestions, catch crops likewise cleaned up in such a way that catch crops very seldom are. New wire fences, and a fine gate with Mahoe posts were erected. Stock were groomed and cleaned until there was not a sign of a tick. The house was put in proper order, new steps and rails painted and whitewashed; the W. C. whitewashed inside and out, yard cleaned up much cleaner than many "Buckra" yards, and even the round-stick hogstye was whitewashed inside and out. As this competitor remarked, if he did not win the first prize, at any rate he had worked for it. The first prize-winner in the third class, good old Thomas Watson, also richly deserved his prize. A man who was married "the year after freedom," and who still takes the pride in his home and surroundings that he does and keeps them so nice, must be a power for good in his neighbourhood. The Holdings were surprisingly good, especially for a parish which I had always understood was "not a small settlers' parish." The amount of cleaning up generally in all the classes is well worth all the money spent on the scheme. It must not be inferred, however, that the whole of the benefits of the scheme consist in the mere cleaning up of "yards," cultivations, fixing up of fences, erection of new gates and making of roads, however commendable these may be.

"It must be remembered that there is still in the minds of the peasantry a good deal of suspicion of "Buckra" and all his works, the biggest and baddest "buckra" of all being the Government, represented, until the advent of the Small Holdings Prize Scheme, in the minds of the average small settler by the Department presided over by the Honourable the Collector General. It would, however, be useless at this time to go into the reasons for these suspicions: Suffice it to say that they exist, and that Instructors in Agriculture have to fight them. It is all very well to send out Instructors, but if the chief and most industrious and reliable portion of the peasantry stand aloof in suspicious contempt, how can the Instructors' labours have the same result as they will have when these people have been persuaded that the agricultural instruction is offered for their benefit, and not as a means for spying out the land and supplying information to the tax gatherer. I do not wish your Boards to take an exaggerated view of this side of the question, but its existence cannot be denied, and until it is removed the full value of the money spent on instruction can never be realized. Remove it and every pound spent will be worth five times what it is now. Twenty-five years of the Prize Holdings Scheme will quadruple the value of the eighty thousand small holdings in Jamaica, and the then Collector General will be able to dispense with what are called runners. That the scheme is

doing away with the suspicion, no man who knows anything of its working can deny: ninety-two entries for the scheme, each competitor paying his shilling in Westmoreland, over eighty promised in St. Elizabeth, is a brilliant comparison to sixteen in St. Mary and twenty-three in Trelawny of last year.

"There is still the most important point left untouched: the facilities gained for personal instruction; as judges the Instructors enter the holdings and go over the various points, the first question usually asked being, "how me tan. sah?" The reply will be, "well you cawfee no prune too good you know," and there and then practical instruction is given on this point or any other point which may crop up.

"We caught one Tartar in this way: At one of the holdings land was being prepared for ginger with the hoe: now, I said if you would only fork that land instead of humbugging about with the hoe you would get a much better crop of ginger; if you have a fork bring it here and I will show you how to use it. A fork was brought by a bright looking youth, and I instructed him to commence forking his way, and I would then show him the proper way. As he commenced to fork I saw that he was a professional. I however let him fork a bit to give me time to get over my astonishment, and then I mildly asked him where he lived, and was informed "same place here." I further asked him if he had been away at anytime to see forking done, and gained a negative reply. I then asked him the straight question as to who taught him to fork so nicely, and was informed that he attended one of my demonstrations and I myself had taught him. I complimented him on his skill and hoped that he would by this example cause all his neighbours to do likewise.

"Various objections have been, I believe, raised against the scheme, one being that people were being awarded prizes which they had not earned. I trust that what I have already said will show that even if this objection had any grounds when the scheme was started they do not exist now, and therefore, no argument is needed for its refutation.

"I am positive that no scheme for rousing competition in this Island has ever been productive of a tithe of the effort which the Small Holdings Prize Competition has. Take the shows, for instance: why all the Shows in the Island do not call forth the effort aroused by the scheme in this parish alone. Mr. Allwood objects to the scheme, I believe, on the ground that the money would be better spent on instruction. I trust I have said enough to convince the Board that this money is spent on the finest form of instruction possible. An objection which I have heard raised is to the giving of marks to "house and sanitary condition." I am astonished that any person should object to any Society attempting to remove the greatest plague-spot in our social system. If an improvement can be brought about in the housing of our peasantry, the greatest step of all would be made toward the improvement of the class, mentally, morally, physically, and in consequence, agriculturally. We want to get the ambition for better things into them, and how this can be done for a class housed in a way that is not tolerated anywhere in the British Empire for the vilest criminal, I fail to see. Then "Sanitary Condi-

tions"—have the objectors ever stopped to consider that this means that the pigs shall be kept in a stye, or a crawl, that the manure shall be put on to the cultivation, instead of the pigs sleeping under the house and the manure lying there to cause fever in the whole family, I hardly think so, or that objection would not be made. I trust, however, that from what I have said that the Board will try their best, not only to keep the scheme going, but to extend it to Holdings up to fifty acres, as well as to augment the number of Instructors, so that the interest stirred up by the scheme may be fully utilised by being converted into systematic and continuous effort. I trust also that gentlemen opposing the scheme will not take it amiss when I say that the only harm being done, or the only way money is likely to be wasted is by their opposing the scheme. Gentlemen holding the high official position of Mr. Allwood are listened to very respectfully when they make utterances which are reported in the newspapers. People are apt to infer from his opposing the scheme that the Government are already repenting of doing good and will soon return to the old evil ways.

"There is one more side to the question which I should like to put before your Boards, and that is, that people are already preparing for the next competition, and also that many holdings have been much improved by its influence although not entered for the competition. Several people said in a superior tone that they "didn't want Buckra prize fe mek dem clean up dem place, if dem only enter, dem must tek prize." The great point is that they cleaned up their places in a way which they never would have done had it not been for the Prize Holding Scheme. I would like to convey to your Boards my high appreciation of the work of Mr. Arnett, and to point out the indebtedness they are under to him for the honest painstaking hard work which he has so ungrudingly given for the benefit of the people, in helping them with the judging in the Small Holdings Prize Scheme. I believe Mr. Arnett is to receive the sum of five pounds for his fifteen days' work; during these fifteen days we travelled not less than 480 miles in the buggy, 50 in the saddle, and nearly 100 on foot. Gentlemen who know Westmoreland roads generally, and remember that the settlers are usually located on the worst of these, will appreciate our labours and not grudge Mr. Arnett his five pound note. Gentlemen who know the roads round Kilmarnock particularly had, I think, better be left to speak for themselves. I do not feel capable of saying anything about the roads in this district without hurting the feelings of the Parochial Boards of Westmoreland and St. Elizabeth.

"With regard to my own share in the work, I have ungrudgingly worked 14 hours a day because I know that I must reap a rich reward in the minds of the peasantry, even if I do not in that of the entire Boards; although I hope to be accorded that as soon as the scheme and its benefits are fully understood by them. And I am perfectly willing to go on doing this for the scheme, but I could not promise to do as much for any other scheme not having the same object in view, as I feel that without this scheme the Agricultural Society so far as the peasantry are concerned is of very little use.

"I append a letter from the Rev. G. H. Lopp, Moravian Minister at Carmel, Newmarket, himself an agriculturist of great skill from

the premier farming districts of the United States of America, giving his opinion of the scheme.

"I have the honour to be, etc.,

W. CRADWICK."

APPENDIX.

Letter from Rev. G. H. Lopp re Prize Holdings.

SIR,

"The success of the Prize Holdings Scheme is very satisfactory to those who have the interest of the people at heart; but, of course, the gentlemen who are for self only will call it a waste of money. I trust, however, that the idea can be carried further. In my opinion such teaching and putting into practice will result in far greater good than all the lectures, however good. At any rate please accept my congratulations on the successful issue of the work in this parish.

"Yours sincerely,

G. H. LOPP."

9th Jany, 1904.

602.—TECHNOLOGICAL MUSEUMS.

OUR attention has been called to this subject by the receipt of the following from the Curator of the Technological Museum of Sydney.

It is quite true that the Victoria Institute of Trinidad has made an attempt to follow on the lines adopted by larger Colonies, but a brief perusal of the account given of the Sydney Museum will prove how completely inadequate, are the collections locally deposited for furthering the agricultural and commercial prosperity of the Island of Trinidad.

It is well known that the work of our local establishment is conducted mainly by voluntary effort which is highly appreciated, but it would certainly be a great improvement if permanent skilled assistance could be obtained and the productions of the Colony shown to greater advantage.

It has been recently ascertained that the Museum of the Imperial Institute is open to receive specimens of produce from Trinidad, but the local Museum should also be able to show specimens and afford information thereon to interested visitors.

The Sydney Technological Museum.

Open to the general public every afternoon of the year except Good Friday and Christmas Day.

Week Days	...	...	...	1 to 5 p.m.
Sundays	...	...	...	2 to 5 p.m.

Open to Country Visitors from 9 a.m.

"The Sydney Technological Museum is a bureau of information to which the public can appeal at any time concerning matters relating to the natural resources of the colony. Thus, for instance, if a breeder of sheep wishes to have a report on the class of wool he is growing or desires to change the strain of its fibre, he has only to send a sample to the Curator, and the required information will be given by the wool expert. There are experts on the staff for the leading branches of industry, and these furnish the latest data on any subjects such as timbers, tans, dyes, gums, resins, kinos, (Eucalyptus exudations), minerals, wool and economic products of the animal kingdom, in fact, on almost anything which is to be found in the industrial life of the colony.

The importance of Technological Museums to the commercial life of a country is now recognised all over the world. The Imperial Institute, and the Philadelphia Museum, U.S.A., are similar institutions, and France, Belgium, Holland, Sweden and other countries have Technological Museums.

The real objects of forming museum collections are two, viz.:— to advance or increase the knowledge of some given subject, and to diffuse this knowledge amongst the general population of a country. Summarised, these two objects may be briefly called *research* and *instruction*, and these are primarily the main functions of the Sydney Technological Museum.

Visitors and others are afforded every possible means of examining and studying the 100,000 specimens of which the museum consists, and it is probably the largest of its kind in the southern hemisphere. Its reputation is already world-wide, for during the past year alone, enquiries were made from Tasmania, Queensland, Victoria, West Australia, America, Germany, France and England, from firms in search of information in regard to the colony's resources and raw products.

A Technological Museum may be defined as a museum in which every exhibit is intended, not merely to satisfy the curiosity of the visitor, but to impress upon him the value and importance of the exhibit from a *commercial* or *economic* point of view. This has special reference to the natural products of a country, and justifies the establishment in such a museum of three main divisions:—botany, zoology and mineralogy. These divisions, however, must not be looked upon from a natural history point of view. Natural history has no commercial aspect, technology has, and treats with natural history objects in regard to their commercial importance.

Thus in botany, the tree "Cypress Pine," *Callitris robusta*, R. Br., from a natural history point of view, merely represents a certain genus of a certain natural order, and a certain species in that genus.

In order to determine its proper place in the classification of plants, it is necessary to examine its flowers, leaves and fruits; but here the natural historian's work ends. To the technologist (who of necessity must be in this case a botanist, so that he may be able to determine the species under investigation) on the other hand. "Cypress Pine" is a yielder of timber, sandarach, oil from the wood, camphor from the wood, oil from the leaves, and such other articles of commerce which to determine lies within the sphere of his work.

To state a point definitely, one may mention the investigations now being carried out on *Eucalyptus Oils*, derived from New South Wales species. From knowledge of what was being accomplished elsewhere, it was apparent that if something were not done to place the industry on a perfectly scientific basis, so as to meet satisfactorily the requirements outside the colony, the foreign markets would be lost to New South Wales. The results that have been obtained so far are of the most satisfactory nature both from a commercial and scientific point of view. The researches have brought to light constituents hitherto unknown, which in themselves have commercial possibilities of great importance.

The same applies to mineralogy and zoology.

During the last twelve years not less than 150 *original pamphlets* have been issued from this museum, all bearing on the commercial development of the raw products of the colony and its economic zoology.

Particular attention has been given to investigating our tans, timbers, drugs, clays, cements, building stones, gems and precious stones, wool, hides, economic zoology, &c.

Researches, both scientific and technical, are conducted with a view to the utilisation of new or little known products, chemical investigations and analyses of all kinds are undertaken with a view to facilitate their commercial utilisation or determine their practical value.

The record for 1899 shows that reports and special replies were mailed to all parts of Australia. This, of course, does not include the vast amount of information given verbally by the scientific staff to callers at the museum.

In comparison with other countries, New South Wales can hardly be considered a manufacturing one, and therefore only raw products are investigated, although, of course, attention is given to any products that will develop commercial enterprise. With increased population our manufactures will no doubt be largely extended, and then new branches will have to be added to the museum.

In addition to the central museum, there are local museums at Bathurst, Goulburn, Newcastle, West Maitland and Albury.

The Curator invites country residents to forward, for identification and investigation, specimens belonging to either the vegetable, mineral, or animal kingdom existing in their neighbourhood that may be considered of interest or have a supposed commercial value. Specimens may be forwarded O.H.M.S. free by post or rail, if addressed, "The Curator, Technological Museum, Harris Street, Sydney.

R. T. BAKER, F.L.S.,
Curator.

603.—THE COTTON INDUSTRY.

Much interest has been taken during the past year in the growth of cotton. A large quantity of seed was procured by the Government and distributed *gratis* to applicants.

Two hand-power roller gins were imported by the Government, and a hand baling press is under way from England.* The use of these machines has been offered to the public free of charge, except for the motive power, and a convenient building has been provided at St. Clair for their working and storage. The machines are also offered to growers in the country free of charge, and under a caretaker and instructor, where there is sufficient cotton to warrant their transport.

Considerable areas have been planted with Sea Island Cotton, but reports received of its growth, are for the greater part unfavourable owing to attacks of insects and disease. The native or creole cotton, which is believed to be short staple "Upland," does not suffer so much from disease, and a sample was recently received coming from a single plant, which weighed 1·71 lbs. This gave on ginning ·54 lbs. of clean cotton. The sample was sent up by the Warden of Tacarigua.

Of the creole cotton there are several varieties, which appear belong to the same class, but some of these have a much longer staple than others. A process of selection already initiated, will probably give a cotton possessing stronger vitality than "Sea Island," which appears at present to be highly susceptible to the attack of insects and disease, but it is hoped that with further experience of cultivation these drawbacks may be avoided. It is certainly yet too soon to speak positively on this point, as the variety has only been a few months under cultivation.

There is another acclimatized variety called "Kidney Cotton," which commonly appears self-sown in many districts of the Island. This shows a coarse and hard lint with large seeds. In regard to this, a point may be mentioned. While this variety in the Experiment Station has been attacked severely by disease, a plant growing in a cottage garden close by is a picture of health and bears large quantities of cotton.

We have thus practically three varieties of cotton under cultivation:—

1. Sea Island.
2. Kidney Cotton.
3. Creole or Upland Cotton in several varieties.

The value of these has been stated as follows by good authority:

Sea Island	...	1/0½d. to 1/4d.—25c. to 32c.
Kidney Cotton	...	5d. to 6d.—10c. to 12c.
Creole or Upland	...	6d. to 8d.—12c. to 16c.

It is to be hoped that local growers will not be discouraged by the failures which generally accompany first attempts, but will give the industry more extended trial, especially the variety known as "Sea Island."

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* Received 28th March.

An attempt is being made to provide a depôt for the purchase of lots grown by small proprietors, as it is found that there is no inconsiderable difficulty in disposing of small quantities.

In Barbados, Sir D. Morris informs me that the local ginneries buy "really fine well-picked Sea Island Cotton, as obtained from the field, at 2d. per pound. This is seed cotton before it is ginned. This is equal to 9d. per pound in Manchester for lint only. Inferior sorts are bought at one penny per pound." - (7th March, 1904).

604.—BANANAS.

Consequent upon the action of the Agricultural Society, the General Manager of the Government Railways, W. E. Smith, Esq., was deputed to proceed to Jamaica to study the methods of transport and shipping adopted in that Island, and this gentleman has furnished the Society with an admirable report, which is here reproduced for the information of readers of the Bulletin.

The Fruit Industry of Jamaica.

REPORT BY MR. W. E. SMITH, GENERAL MANAGER, TRINIDAD GOVERNMENT RAILWAY. SPECIAL REPRESENTATIVE OF THE SOCIETY.

To the Secretary, Agricultural Society of Trinidad.

Sir,

"In compliance with the Resolution of your Board passed at its meeting on the 13th October, 1903, and under the sanction of His Excellency the Governor, I proceeded to Jamaica on the 5th January, 1904, for the purpose of inquiring into, and reporting upon the methods of handling, transporting and shipment of Bananas and Oranges as practised in that Colony.

"I returned to Port-of-Spain on the 29th of the same month.

"2. To have confined my investigations to the mere handling and transporting of Fruit, I should have had a comparatively short and easy task, for the reason principally that very few shipments were being made during the time I was in Jamaica, in consequence of the hurricane last year having retarded the crops in most of the big banana districts. The opportunity was therefore afforded me of seeing much else that was interesting and instructive, both with regard to the cultivation, and the general development of this remarkable industry in our neighbouring Colony. I propose including in this report a few out of the many such notes and observations I was enabled to make, my object being to interest those who are already taking, or intending to take, some active share in the establishing of such an industry here in Trinidad.

"3. The value of the Fruit exports of Jamaica exceeds one million pounds sterling, annually, or over sixty per cent. of the total exports of the Colony. Nearly seven-eights go to the United States, and the remainder to the United Kingdom and other British possessions.

"It is estimated that 33,000 acres are under Banana cultivation, comprising 240 Estates or thereabout, varying in acreage from twenty

to five and six hundred : and hundreds of small settlers scattered far and wide, with holdings of less than 20 acres. During the past five years the shipment of fruit from Jamaica has just about doubled itself. Last year the total number of bananas grown and exported was in the neighbourhood of eight million bunches.

"4. The largest areas of cultivation lie in the valleys and slopes along the sea-board, but there are also plenty of Estates in the hilly districts, and in the 74 miles railway journey from Kingston to Port Antonio, bananas are everywhere to be seen. The route lies for many miles over a stiff mountain range, and on all sides there were small patches of bananas.

"Even in the crevices of rocks, healthy plants were growing and thriving upon the rich wash mould to be found thereabout. Upon the plains too, on the Southern side of the island, old abandoned cane lands have been transformed into luxuriant banana groves, yielding, by the aid of irrigation, 300 bunches to the acre.

"5. There is, I am informed, a great variety of soil in Jamaica, good, bad and indifferent. In some districts little manuring is done, and in others a considerable amount is necessary. To supply this demand a great deal of stock is kept, which, combined with banana growing, seems to be a most profitable business for big and little man alike.

"High cultivation is aimed at as evidenced by the absence of undergrowth in most places I saw, but labour difficulties are just as prevalent with them as with us. Ploughing, harrowing, and forking, both before and after planting are universally practised, and the benefits of good drainage appear to be of first and foremost consideration. In short, the whole object is to produce the biggest crop possible, and the finest fruit, for upon these, and the most careful handling, hang the entire success or failure of banana growing.

"6. The handling and transporting of ripe fruit is perhaps the greatest difficulty both growers and shippers have had to meet and are still contending with. So watchful are the shippers, and so stringent their rules, that it is now well nigh impossible for an unripe or even slightly bruised bunch to be accepted at any of their depôts.

"Consequently the growers, great and small, being very much alive to their own interests, take exceeding good care to ensure compliance with the buyers requirements, inexorable as they be. A methodical system of tally and supervision prevails on the larger estates, whereby careless handling may be promptly brought home to the offending labourer or carterman, and by these means all classes are becoming educated to the knowledge that care pays in the long run, and wanton neglect brings almost certain loss to the individual.

"The finest and best-conditioned fruit invariably commands the topmost price, and preference is always given to really cultivated bananas, long experience having shewn (so I was told by one of the principals of the United Fruit Company) that they are by far the best carriers.

"7. As to variety, there is only one in Jamaica and it is called by the generic term "Banana" or "Fruit."

"It is of course the "Martinique" or "Gros Michel" sort known to Trinidad growers. An inconsiderable quantity of the red variety is also grown in Jamaica, and is occasionally shipped away, more as a decorative fruit than anything else, realizing fancy prices. The smaller kinds of "figs" I saw very few of in any part of the Colony, and the banana of commerce was not in my opinion superior in either size or flavour to our ordinary "Gros Michel" in Trinidad. With regard however, to the size of the average bunch (*i.e.* the number of "hands") there can be no question that ours are inferior. I am judging merely by Mr. Symington's shipments, but there is, I believe, no reason whatever why, with proper cultivation, the size of bunches of bananas grown in Trinidad should not rival, and even eclipse, those produced by any of our neighbours.

"8. Upon this question of "size" I will afford a few particulars of the regulations that have become the recognised standard in Jamaica for buying and selling. A full bunch or "Straight," as it is technically known, consists of nine hands or better eight hands count as three-quarters, seven hands as a half and six hands as a fourth. Abnormal bunches of 14 and 15 hands are generally subject to higher prices by arrangement.

"At first glance the advantage of this method would seem to be all on the side of the buyer, but in effect it is not so, being more or less mutual.

"Big bunches mean better fruit, more convenient handling and safer carriage, also higher prices from the wholesale dealer. These the shipper requires, and pays his premium for getting. He doesn't want small and inferior specimens, and will only take a limited proportion of them in any case.

"On the other hand the grower cannot, under the most favourable circumstances, avoid a certain percentage of small bunches, and he is quite satisfied to sell them at the reduced rates referred to. The fruit cut from young plants is usually undersized.

"Patches of inferior land and unfavourable situations produce similar results, and from a variety of causes the planter is obliged to reckon upon a proportion of low grades in his annual crop. At any rate the arrangement seems to work all right in Jamaica and is generally considered to be perfectly equable. Its reaction upon the cultivators is moreover far-reaching and beneficial, inasmuch as it forces upon them the all-important necessity of good tillage, intelligent management, and careful handling, as the only means of realizing satisfactory returns.

"9. The prices paid by buyers and shippers vary according to the season, and the exigencies of supply and demand.

"For the English Market, the best prices are obtainable in the Summer and Autumn months, and for the United States, from April to August.

"So far as I was able to ascertain, the highest figures reach £12 10 per hundred bunches, and the lowest £5, the average being £7 10, or one shilling and sixpence per bunch of nine hands. Delivery in all cases to be made at the nearest depôt or railway station.

"The large exporters enter into agreement with the growers to take fruit all the year round at a fixed scale of prices.

"Penalties are enforced in the event of failure to supply the stipulated quantities, and the business is worked under a splendid organization. It is nothing uncommon, in the height of the season, to load a dozen large steamers in a week with fruit drawn from every part of the island.

"These large buyers are connected by telephone and telegraph with their various agents all over the Colony, and a few hours' notice suffices to cut, transport, and load a ship with 30 to 40 thousand bunches. One estate I visited had a few miles of its own tramway, and the proprietor told me that his fruit was usually alongside the ship 4 hours or so after cutting. Where much heading out and cartage has to be undertaken, the operations are necessarily more tedious and costly, but the prices paid for good sound fruit allow of a very fair margin, and (excepting in the case of standing agreements) payments are invariably made straight on delivery. The cultivation of bananas is consequently widely taken up by the peasant classes, who appreciate more than anyone quick returns for their labour.

"10. The average distances over which bananas have to be headed, crooked, and carted in Jamaica is certainly not less than it would be in Trinidad, while the physical difficulties to be overcome amid their mountains and deep valleys are incomparably greater than with us. It is true that they have an excellent system of Main and Parochial roads, also bridle tracks, extending over the length and breadth of the island, but even with these advantages, journeys to the railway and sea-board are by no means easy or short. Jamaica is a biggish place, being about two and a half times the size of this Colony, and nearly two thousand square miles of its total area lie 1,000 feet or more above sea level.

"In Trinidad the want of good and sufficient roads into some of the interior districts is a serious drawback, no doubt particularly during the rainy season, but it must be admitted that these deficiencies, which are slowly but surely disappearing, are confined to but a comparatively small portion of the settled and partly developed lands of the Colony.

"Everything considered, I venture to state that the natural conditions here, including rainfall, all favour profitable banana growing, and we are happily not liable to hurricanes such as swept the standing crops to the ground in Jamaica last year.

"There is striking proof of the adaptability of our soils and climate in the luxuriant growth of bananas to be met with in all directions, and on all varieties of land, many of them growing and thriving in a practically wild state.

"11. The selection of soils, situation, and season for planting bananas, and many other things connected with the practical side of the subject, are matters that must necessarily be left to our experienced agriculturists. I do not know whether any treatise on banana growing has ever been published in the Bulletins of the Royal Botanic Gardens. Very possibly one or more have, and should this be so, a reprint would be of value just now. A paper on "The Banana

Industry in Jamaica." prepared for the Agricultural Conference in Barbados, January, 1902, is printed in pamphlet form, and its pages afford a very useful amount of information.

"It supplies the Alpha and Omega of banana culture, and ought to be read by all those interested in the industry.

"The several examples therein given of the debit and credit side of things agree with my own observations, and the particulars I personally obtained on the spot.

"One estate I visited afforded some very interesting details. It consisted of 300 acres of converted cane land principally, and had been in cultivation about three years.

"The cost of cleaning and preparing the land, ploughing, planting, weeding and pruning was a little over the average of £10 per acre. The initial expenses were fully realized with the first fruiting, after which, the net clearance each year amounted to not less than £10 per acre. This is typical of many estates, both where irrigation is carried on and otherwise. It is a simple calculation. An acre of bananas planted, say 14 x 12 feet, will give roughly 250 plants, or 3 stems to each stool. Under good tillage, and with average luck, these should produce not less than 300 bunches annually, extending over the ratooning period, which varies from 3 to 6 years. To be on the safe side, suppose we say 260 full paying bunches which realize the average price of 1/6. The gross revenue comes to £19 10s., and after deducting say 45 per cent. for general management, including propping the fruiting stems, reaping, carting and interest on capital, the net clearance is £10 per acre and not less. It is generally conceded that 100 acres of bananas in full bearing, under average conditions of soil, cultivation and rainfall, means an income of £1,000 a year. This of course applies to Jamaica where the market for bananas is certain and steady. In specially favoured districts, and irrigated lands, the profits are much higher, and when stock-keeping is combined with cultivation, or where young cocoa and other products are interspersed between the bananas, there must obviously be a much wider range for profitable speculation than could possibly be found in any other farming industry known to the West Indies.

"12. To describe in detail all that I saw and learned with regard to planting and treatment of growing crops, would be travelling even farther than I have already gone outside the real object of my mission to Jamaica. I saw sufficient to convince me that we have a very great deal to learn from our neighbours in that Colony, but of course they have been twenty years or so at the business, and bananas to them have been, and are, what cocoa at present prices is, and will be (so long as those prices continue,) to many of our planters and small settlers.

"It remains, however, to be seen whether the latter could not advantageously plant the "Gros Michel" more generally than is now done, as shade for young cocoa, and I am quite sure that with capital and enterprize there are (exclusive of Tobago,) thousands of acres of idle lands within 20 miles of Port-of-Spain—much of it conveniently served by roads and railways—that might be profitably taken up for bananas alone.

"Should cocoa ever touch say 45/- and stay there awhile, no further argument would, I imagine, be necessary, and the world's production is increasing so enormously, that in the natural sequence of such things there is bound to be a gradual but certain levelling of the prevailing average prices as time progresses.

"13. The important lessons they seemed to have learned in Jamaica may be briefly summarized as under :—

"(i.) Thorough preparation of the land before planting, good drainage, and free use of the plough, fork and hoe afterwards.

"In other words, nothing but high cultivation pays in the long run.

"(ii.) Planting at such time only, and pruning of suckers, as will ensure fruiting, and proper rotation, during those months when the highest prices prevail.

"(iii.) Religious care in cutting, handling and transporting the ripe fruit, without which everything else counts as nothing.

"14. The process of cutting, handling and transporting is one of unceasing care and anxiety. The stem is cut on the top, just below the head, when the bunch topples over and is caught by a second helper. It is not allowed to fall to the ground. A sharp machete or cutlass does the requisite trimming, and the refuse is afterwards chopped up and left on the soil. The remaining stump is allowed to gradually rot from the top, which admits of the heavy amount of sap it contains being slowly returned to nourish the young suckers at its root.

"Following this, the bunches are roughly graded and tallied, and headed out to some convenient place, and there packed in trash to await the later removal to the nearest railway station or shipping depôt.

"All this is done under the eye of an experienced Overseer.

"Donkeys are used for carrying the bunches crook fashion, and where carting has to be performed the fruit is carefully stowed in the vehicles, trash being used to prevent bruising and chafing.

"It is a crime for any person to even attempt to accommodate himself on the top of a load of bananas in transit.

"The wagons and carts generally used are made with springs, and are fitted with high sides and ends, as light and open as possible. A fuller description of these conveyances will be given further on. When the journey has to be performed partly by rail, the bananas are brought to the station and transferred to the wagons with the same amount of watchfulness and care as before. Trash is again used, and the work of loading is undertaken almost entirely by the buyer's agents.

"I enclose a photograph that describes this operation perfectly.

"15. In Jamaica railway freights are generally paid by the shippers, as they doubtlessly would be here, and such charges are very considerably in advance of those contemplated in this Colony.

"Their scale is as follows :—

"Full car loads, carrying from 300 to 750 stems each—15/2 to 26/10 per 100, up to 32 miles (including wharfage and shunting charges of $1\frac{1}{4}$ cent. per bunch), equal to $4\frac{3}{4}$ cents per bunch, average distance.

"When sent in less than car loads, 2/- per 100 must be added to the above, which brings the freight to about $5\frac{1}{4}$ cents.

"I have confined these particulars to the 32 miles freightage, as approximating more closely to our local circumstances, but it will be obvious at once that if $5\frac{1}{4}$ cents be the mean, the railage cost when say 20, 30 or 40 miles are reached, becomes a rather serious calculation in Jamaica.

"Yet, the industry there thrives, and the Railways are owned and worked by the Government. So far, in Trinidad, we have loaded, carried and delivered bananas alongside the wharves for 3 cents per bunch, experimentally, I may add, and irrespective of quantity, large or small.

"I heard of no such thing as free carriage of fruit in Jamaica, nor of any other direct artificial aids to the growers.

"There is, however, a system of agricultural instruction provided by the Government, and a great deal of practical demonstration of the right sort is thereby brought home to the small agriculturists all over the Island.

"16. The actual performance of putting bananas afloat I am unable to speak of from personal observation, for reasons already explained. The whole process was described to me by the United Fruit Company's people, and its main feature consist in heading and shouldering the stems from the sheds on the wharves into the holds of the ship—combined with the smart work done by the Expert Checkers, under whose eyes every individual bunch undergoes a final inspection. These fruit vessels also pick up round the coast, and the bananas have then to be handled from shore to ship in boats of various kinds.

"In the Boston Company's Steamers the fruit is stowed on simple racks or bins, without any trash whatever, and the holds are specially ventilated only. The comparatively short voyage of $4\frac{1}{2}$ to 5 days does not call for any other treatment: but with the Imperial direct line to Bristol, and the Elder and Fyffe's boats to Manchester, cool storage on the most approved principle is provided.

"I do not think that many Jamaican bananas are crated. A system of care that is never relaxed from start to finish would seem to take the place of any such precautions, which are not only costly, but go to reduce the carrying capacity of the ship's holds.

"I was told that in vessels properly installed with cool chambers no crating is necessary, not even trash.

"17. During my visit to Jamaica, I made some useful notes and comparisons with reference to the conveyance of Fruit over the Government Railways there, and without going into details at this moment I may say at once that I see no special difficulty in affording all the conveniences necessary for handling a large traffic here whenever the demand arises.

"The question of the kind of carts used upon the roads also received some attention, and, at your request, I visited the firm of Messrs. Cordova & Brown, in Kingston, for the purpose of examining their specialties. The 4-wheel waggons as well as the 2-wheel carts are admirably adapted, I consider, for our country roads. The former will accommodate as many as 150 stems of bananas, equal to 3 tons, and the carts about a third of that quantity. These vehicles are light and exceedingly strong. I enclose 3 photographic drawings of them, together with the final offer of the firm. The prices f.o.b. at Kingston are £26 and £10 for the Waggon and Cart respectively, and if it could be arranged to get a pair of them over, as examples, and offered locally at cost, I daresay ready purchasers would be forthcoming.

"The vehicles are designed for general purposes as well as for the conveyance of Fruit, and for long cartage of cocoa in our country districts they would be a great improvement upon the description of cart in common use here.

"18. With regard to the question of purchasing suckers, I made enquiry in all likely directions, and finally, by the aid of Mr. Fawcett, the Hon. Director of Public Gardens and Plantations (to whom I am indebted for many other acts of kindness) I was enabled to close with an offer of 8s. per 100, delivered packed on the Royal Mail Wharf, subject to inspection before shipment.

"Captain Constantine has also been taking a personal interest in this matter, and is giving all the facilities in his power, including a special through rate of 2/- per 100. These suckers are being obtained from the hilly districts, which Mr. Fawcett considers is an advantage, on account of their hardiness.

"A trial shipment was to come forward by the *Trent* and it is probable that the cost, landed in Port-of-Spain, will be nearer 10s. than the 15s. previously contemplated. You will probably delay any further shipments just yet, seeing that the dry season is at hand. The United Fruit Company was prepared to supply any number of suckers at 10s. f.o.b. the Coastal Steamer, to which would have to be added another 2s. for transhipping and packing in Kingston. This seems to be the fixed price in all quarters, and the offer of 6s. 3d. you received from a Mr. Dill, meant delivery at Albany station, 40 miles up country, and when railage and cartage to wharf in Kingston were paid, the total expense would come to about the same thing, viz., 10s., exclusive of packing.

"19. I have dealt so far in my report with the Banana section only of the Fruit Industry of Jamaica, believing that this is more likely to command the greatest share of our attention in Trinidad. Oranges, Grape Fruit and Pines, however, figure in no insignificant degree in the total value of their exports.

"During last year they shipped nearly 71 million oranges, equal to 180,000 barrels, 8,011 packages of grape fruit and 8,220 dozens of pines. The Railway freights realized £14,348 from oranges and grape fruit in the same period. The scale of charges varies from 6½d. to 1s. 2d. per barrel up to 32½ miles, which is more than double the present and probable railage cost in Trinidad, for even small quantities. It may be interesting to here note than in addition to the above

the Railway revenues from banana traffic in Jamaica totalled the respectable sum of £26,306, covering the last financial year.

"The Jamaica oranges possess a very fine texture and exquisite flavour, but they are in my opinion inferior in size and appearance to those ordinarily grown here, while the best of our varieties would be hard to beat anywhere.

"The greater proportion is sent to the States, but of late years considerable quantities have been put on the English Market, and found much favour there.

"Notwithstanding a protective duty of $1 50 per 70 lbs. gross in the States, it seems that the Jamaica growers can still make a profit out of oranges so long as the Florida and California fruit is not in season. It is to the English Markets that the buyers are at present looking, but the general complaint is want of more frequent shipping facilities than are afforded by the fortnightly service to Bristol by the Imperial Direct Line.

"Several Planters told me that if the Royal Mail would fit their steamers with cool storage, regular use would be made of that route, thus giving them a weekly opportunity, alternating with the Elder Dempster boats.

"The large buyers of oranges pay from 1s. per 100 to as low as 3d. delivered at the nearest railway station, and the process of grading, wrapping and packing is done very much in the same manner as that followed by the Symington Syndicate here. The prices realized in English Ports are subject to great variation, according to quality, condition and season.

"Last Christmas the best quality of Jamaica oranges fetched in London from 12/- to 14/- per box of 200, a statement I should myself scarcely credit were it not taken from a very reliable source indeed.

"On all sides I heard the same story, that profits or losses (as with bananas) depend absolutely upon the kind of care given to the selection and handling of oranges before shipment, and to the maintenance of an equable temperature throughout the sea voyage.

"Quality and condition, as with most things, will always command and hold the best markets, and the Jamaica people seems to be fully alive to this.

"Budding of the choicer sorts is practised to some extent, and hybridizing experiments are also being carried out with the Ripley and Cayenne varieties of pines, the special object being to combine the superior edible qualities of the one with the more symmetrical shape and size of the other.

"20. In concluding this Report, it is fitting perhaps that I should offer some explanation of its length and divergence from the original text of my instructions. This fruit industry presented at every turn so many other interesting and instructive features, more or less connected with transporting arrangements, that I considered it would be a profitless use of time and opportunity did I not enlarge somewhat the scope of my observations and enquiries.

"Through the courtesy and ready assistance given to me by the Government, including the Director of Public Gardens, the Director of Railways, and the Secretary of the Agricultural Society, I was at

once placed in touch with some of the leading planters and large shippers of fruit, and though my time was limited, and distances in Jamaica long, I had in a variety of ways exceptional opportunities for observing things, and acquiring information in the most reliable quarters.

"The impressions given in this report are those left upon a perfectly open mind, though I am fully conscious that in expressing opinions, and offering suggestions, with regard to the purely agricultural side of the question, I have been occupying both delicate and unaccustomed ground.

"21. I am nevertheless convinced that the growing of bananas for the English and American Markets might be profitably undertaken in this Colony, disregarding altogether the examples I have quoted of profits made in Jamaica. Personally, I should be satisfied to take those figures at 50 per cent. discount when there would still be left a net yield of £5 per acre. It is an axiom in Jamaica that nothing responds so readily to good cultivation as bananas, and over a short series of years an average estate will give *just about double what is spent upon it*, all other things being equal.

"The development of the industry here will have to be taken in hand on a large scale if the Royal Mail (or any other Steamship Company) is to be expected to fit ships with modern fruit storage, and afford regular sailings. It is either that or nothing.

"The transhipment of bananas from lighters and coastal steamers into the ocean ships, while increasing the cost but very slightly, and necessitating extra precautions, need hardly enter into the growers' calculations, seeing that those services and risks will belong exclusively to the buyers and shippers.

"To keep pace with the small and irregular crops that would come forward during the first year or so of the establishing of the industry, arrangements would have to be made for adequate cold storage on the Royal Mail Ocean Steamers at least once a month, in order that sales might be realized, and to prevent disappointment at the outset. And in this connection, two of the Trinidad Line boats have already a limited accommodation for carriage of perishables, and it might be possible to get the Shipping and Trading Company to offer an outlet in the direction of the New York markets.

"22. If the growing of fruit on any substantial and lasting scale is seriously taken up by the people of this Colony, it will be deserving of, and will doubtless receive, in its initial stages, at any rate, every material assistance the Government can reasonably give to it, and if I may be permitted to make a final suggestion, it is that His Excellency the Governor might be approached with a proposal to sanction say 100 acres of St. Augustine lands being laid down in bananas, under the direct control of the Manager of that Estate, to be followed later on by offers of other suitable lands in that district and elsewhere to large and small capitalists, on easy and attractive terms, for the same specific purposes.

"I can conceive no more useful nor certain way of preserving and stimulating the interest that has already been aroused by Mr Symington and his influential Syndicate in this important though long neglected industrial resource of the Colony.

I am, Sir, &c.,

W. E. SMITH,

18th February, 1904.

605.—"MOTHER LIQUOR" OR "WASH" FOR RUM DISTILLATION.

Many people suppose that rum made from cane juice must necessarily be of finer flavour or of superior quality than rum made from molasses, skimmings, etc.

This is, however, far from being the case: as it is first necessary for all the saccharose of the cane juice to be inverted or transformed into glucose, before the sugar it contains can be converted into alchohol.

With cane juice, fermentation generally takes longer time, than with molasses, as the latter contains but a minimum amount of saccharose or sucrose, and a maximum amount of glucose, which is already in a state fit for fermentation, while in cane juice the exact reverse occurs, as it contains a maximum of sucrose and a minimum of glucose, and the sucrose has to be converted into glucose before rapid fermentation can take place, and the sugar it contains in the form of glucose converted into alchohol. An examination into the methods adopted in Jamaica and Trinidad distilleries appear to show, that a great loss of spirit occurs in the making of high flavoured rum, and some makers argue that what is gained in quality is lost in quantity.

Given a pure cultivation of the ferment which produces flavour, it is reasonable to suppose that waste might easily be abolished; but of course, it may ultimately be proved, that the character and growth of the ferment is such, that it cannot possibly be produced in any other way than under the conditions as appears on estates producing high flavoured rum.

The flavour of beer, wine, butter, cheese, &c., &c., is a factor known to be controlled by fermentation organisms or Bacteria. Why rum should be an exception, and why pure cultures of the ferment producing high flavoured rum have not been produced, is due it appears owing to its value not being fully recognised.

There is little doubt however from recent research that flavour does not depend upon the form of sugar material, but on the organism or ferment, used for its conversion into alcohol, as different flavours are obtainable by the use of different kinds of ferment.

The subject was taken up some years ago in Jamaica and Trinidad, and in Bulletin for 1897 and 1898, articles appeared on the subject which discussed the matter, and the subject is now again being prominently discussed in a neighbouring colony.

The principal object of such enquiries is to find such ferments as will permanently give desired flavours.

Given the proper ferment there appears to be no reason why Trinidad should not make rum of as high a flavour as Jamaica, and that Jamaica should be able to make all her rum of one quality or standard, which is far from being the case at present.

The matter being now again under consideration, Trinidad distilleries will watch with interest the progress made under Jamaica conditions, and wish our neighbours every success.

The ferment which occurs naturally in the liquor or wash in Trinidad distilleries is one capable of attenuating a liquor of a density of 1060, to a density of 1004, in 48 hours, and this gives when distilled a return of one per cent. alchohol for every five points of attenuation. A properly fermented wash made up on Trinidad lines should give 11 per cent. of alchohol when started at a specific gravity of 1060. The ferment is very rapid in its action, as may be seen by the vats boiling as if heated by a steam coil, during the process of filling and before they are half full. This ferment gives a large quantity of clean spirit, absolutely wanting in flavour. If it were possible to find a ferment giving a high flavour with as large a return of alchohol, our distillers would be highly pleased, as it would mean a considerable increase in their returns.

606.—CACAO :

"River" Estate, Diego Martin.

The above-named estate is situated in the Diego Martin valley, and was purchased by the Government some years since to secure the sources of the water supply for use of the town of Port-of-Spain. After being let on lease for some seasons the lease has been terminated, and the Botanical Department has been directed by authority to assume charge thereof on behalf of the Government. Once a large sugar estate, the land has been largely planted up in Cacao and affords produce of the finest quality. Charge was assumed on 16th January, and Cacao has since been picked, fermented and dried, which was sold in the local market at $13 20 to $13 60 per "fanega,"* for ordinary sample. For picked sample over $14 was offered. Mr. J. C. Augustus, formerly a cadet of the St. Clair Experiment Station, has been put in residence, as Manager, and the cultural harvesting operations have been carried out under his control. The quality of the Cacao on the estate is fully proved by the price obtained, and one of the leading merchants declared it to be as fine a sample of Trinidad estates Cacao as he had ever seen, and as it has brought "top prices," there can be no doubt that the Cacao grown is of an excellent strain. The method of preparation adopted, is that common to all first class estates, and the produce is classed as "lightly clayed Cacao."

Samples of the produce has been sent to be deposited by the permission of the Government in the Economic Museum of the Imperial Institute, London.

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* Fanega = 110 lbs.

607.—HONEY.

The experiments in Beekeeping have been continued at the St Clair Experiment Station. Honey was scarce during the latter part of 1903, and Colonies became somewhat weak, but with the flowering of the logwood in January, February and March, a marked improvement set in and honey of excellent quality was produced. The Colonies are now fully Italianized, and it is found that this class of bee can withstand the attack of the Bee moth much better than the ordinary bee. One Colony, however, succumbed to the worst attack ever seen. It may be mentioned, however, that this was a Queenless hive which was unable to compete with the invaders. From one colony during March, a *super* was taken giving over 20lbs. of "maiden honey."

In the early months honey collected by the bees was very inferior, and some *supers* contained honey which fermented in the comb. It has not yet been ascertained to what cause this occurrence is to be attributed.

608.—AGRICULTURE IN OUR COMMON SCHOOLS.

This is the text of a paper read by an American professor at Long Beach, U.S.A. All over the United States of America it is recognised that agriculture in all its branches, including stock-raising, fruitgrowing, dairying, etc., is the mainstay of the great republic, and hence the constant cry for the teaching of agriculture in the State schools.

Professor J. H. Reed said :—

"In seeking for the reasons of this slow progress among the agricultural masses, I think a valuable hint may be had from some of the more progressive agricultural countries of Europe, where they commence their agricultural education in the common schools. In the little country of France, less than half as large again as California alone, agriculture is taught in over 3,000 primary schools. Seventy-seven experiment stations are maintained, besides the nine National schools of agriculture. Doubtless the high condition in which farming is found in all the principal agricultural districts of that country is largely the result of these agricultural schools and experiment stations, but the interest in them was first aroused in the common schools.

"Provision for technical education in our grammar and high schools is rapidly, and deservedly so, becoming popular all over our country. Large sums are allowed for equipment. Thousands of children become familiar with the nature of materials and expert in handling tools, greatly to the advantage of those who choose mechanical trades later on, while practically no attention is given to the occupation in which one-half or more of our people, sooner or later, find their life work, till a scattering few make their way to the agricultural college. It is as practical to teach children the character of soils, of plant life and growth, and to equip for the illustration of these, as to teach and equip for illustrating the mechanical trades or domestic arts. This primary training in our public schools would not only result in

greatly increasing the number in our agricultural college, but would result in interesting many who go direct to the farms in the practical work of the experiment stations."—*Queensland Agricultural Journal*, January, 1904.

609.—AGRICULTURAL EDUCATION IN SCHOOLS.

An appendix to the report of the Superintendent of the Botanic Station, British Honduras, gives the substance of a lecture on the above subject, given by the Superintendent (Mr. E. J F. Campbell) on the above subject. From it we take the following extracts:—

"Physical and mental health should be the supreme aim of the elementary teacher.

"It is of great importance that the use and exercise of body and mind in the elementary stages of children should be pleasurable and joy-giving; half an hour a day may be spent in the school garden among some sort of plants and flowers; the handling of gardening tools, &c., would even be of considerable benefit. The power of joy has then an expanding and inspiring influence—in fact, it is absolutely essential to the wellbeing of all children.

"The child is much influenced at this period by its emotions and feelings.

"Teachers should realize that it is only by experience through the various senses that the sensory areas of the brain can be modified. A child's energy and force depends upon the character of the brain—the supreme centre. Nature study is the only brain builder.

"It is not intended here to outline any particular course, but what is meant is just to open the minds to the requirements of agriculture and agricultural training, to give some idea of this wonderful science.

"The system now of teaching and the curriculum now laid down by the education authorities is undoubtedly good, but so far as agricultural education is concerned, there is room for much improvement. What is desired is an education in our schools by which the children may be instructed in those matters which will be of particular service to them as farmers; and I am sure the introduction of Agricultural School Readers, giving the principles of agriculture and forming a continuous upward course of information, would be of great value, attraction and interest. Object lessons—school gardens attached to the school grounds, where the rudiments and elementary science of agriculture could be demonstrated and practically illustrated also—prove of the greatest value in the education of the rising and future generation. Then let us, one and all, endeavour to make an effort in providing a progressive initiation in introducing agricultural education, and let the first principles of agriculture be one of the features in our schools.

"It must be borne in mind that what is aimed at is the educating in the science and practice of agriculture, and the training of the young mind to the study of Nature, so that the natural surroundings of our young may present new beauties and fresh interests and possibilities to them, and reconcile them to the so-called monotony of a country life.

"To most of our people the germination, development, and reproduction of vegetation are a mystery, and the realization that plants are living and breathing organisms, performing all the vital functions of such, must come as a great revelation to the majority of our rural friends.

"A knowledge of the forces of Nature as they work through plant and soil, the wonderful adaptions of these forces, and the interdependence of the mineral, vegetable, and animal kingdoms is what is wanting. An intelligent knowledge of Nature in her various phases should be so much power in the youth of the colony, which he will be able to use to his advantage: with such knowledge his lot will be infinitely more congenial to him, his prospects more cheerful, and his inclination will be to remain amid his rural surroundings and apply himself to the cultivation of the soil. Thus it is hoped the people of this colony will be led to develop its great agricultural resources. We trust this will be realized.

"In the carrying out of the science of agriculture in any form, keen observation, object lessons, and practical training, are most essential. Agricultural education also rests on Nature study. The first thing to do with children is to impress them with the love of Nature: teach Nature in the schools.

"The element of education which is most lacking in our schools is the training of the powers of observation. The children need above all things to be taught to observe carefully and correctly, and to state their observations in clear and terse language. The ordinary child, whether in the country or in the town, actually sees and knows comparatively little in the world about him. The wonders of the trees and plants around, of birds, beasts, and insects about him, float like shadowy visions before his eyes: "seeing he does not see": he needs a teacher who can open his eyes and fix his mind on the realities among which his life has passed. This accurate observation of actual objects and facts is the only foundation upon which scientific attainments can rest. It is for Nature-teaching that the child mind craves: with it the school becomes a delightful place, and the teacher a messenger of life.

"I will give you in just one simple instance the value of object lessons and practical demonstrations: Supposing you wish to pot a plant, and you read in a book on gardening, if you have one, as follows:—

"Take up the plant carefully with a trowel, fork, or spade, remove a portion of the ball: then get a clean, dry pot; set the plant in the centre, not too deep, the collar should be just half an inch below the edge of the pot, and fill up with rich garden soil: after that water it well, and keep in the shade a few days.

"Could you carry out these instructions completely without ever seeing the thing done before? I doubt it. But if I was to read that, I would understand it easily, having seen it done and actually done it.

"A course for the study of agriculture must consist very largely of the principle underlying the practice—that is, the child must be taught why he plants, cultivates, and reaps, in one way rather than another, and what laws of Nature he violates in the bad management of his crops, &c."—*Queensland Agricultural Journal*, January, 1904.

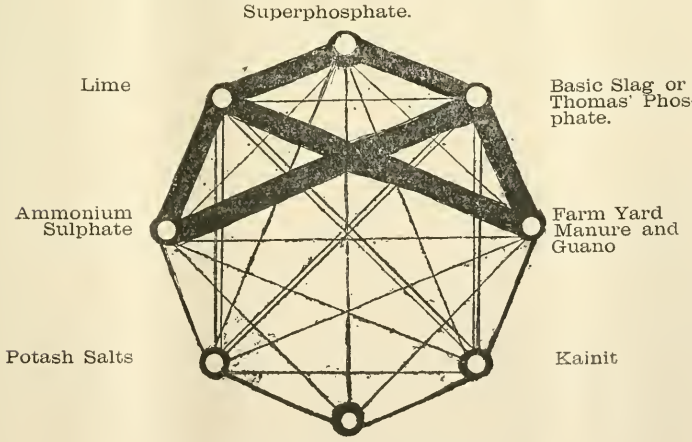
610.—MANURES AND HOW TO MIX THEM.

Dr. Geehens, of Alzey, Germany, has furnished a very simple plan of determining what artificial manures may be mixed, and *vice versâ*. From the *Australian Agriculturist* we take the following notes and accompanying diagram :—

"In mixing manures before applying same on the land, chemical changes can take place, so that a valuable ingredient may be lost by a part of it flying off as gas, as example, the mixing of lime manures with such that contain nitrogen, as stable manure, guano, or ammonium sulphate, when the most valuable ingredient, the nitrogen, is lost in the form of ammonia : or an easily soluble manure changes into one difficulty soluble, and so loses in value, as example, the influence of lime on easily soluble phosphates.

"Secondly, mechanical changes can be caused by mixing two or more manures, and so make their application more difficult, and consequently more costly. Mixing kainit or other potash salts with other artificial manures, if not spread immediately, will give a mixture that soon becomes a hard, solid mass, which must be broken up before application.

"To remember what manures can be mixed for any length of time, shortly, or not at all, before spreading the same on the land, cannot be expected of any one who is not well up in the chemistry of manures The accompanying diagram, which can be relied upon, is valuable for reference. For this purpose it can be tacked on the barn door, and everyone can see at a glance what manures can be mixed, and how long before spreading same on the land.



"Those manures joined by the thick lines must never be mixed before using : those by the double line, immediately before spreading ; and those by the single line can be mixed together at any time." Unfortunately, there has been two lines left out in our diagram. These should run between the base point and the right and left upper angles. These may however be easily drawn in by the reader.—*Queensland Agricultural Journal.*

611.—GRADING AND PACKING FRUIT AND VEGETABLES.

Intensive cultivation has been carried in many places to a high pitch of excellence, and British horticulturists pride themselves, justly, upon their skill as producers. Admirable and necessary as the highest cultivation must always be, yet something more is required to ensure complete commercial success, namely, the conveyance of the produce in the best possible style to the market or to the consumer. It is at this point too many fail, and a material proportion of unprofitable sales is mainly attributable to neglect in presenting goods in the most satisfactory manner. Proofs of this defect are evident in every British market, and commonly the produce of the home grower may be seen in direct contrast with that of his foreign competitors, to the conspicuous disadvantage of the former. It is the purpose of the following notes to give some directions that, with the exercise of intelligence in carrying them out, may assist in improving the selling value of both fruits and vegetables as produced in this country.

To aid in grading fruits to the best advantage, it must be assumed that the preliminaries of successful cultivation have received due attention. The selection of the best varieties, suitable sites and soils, with every possible care in protecting the trees from attacks of insects and diseases, demand the cultivator's utmost skill and unceasing watchfulness. Finally, in preparing for the actual work of grading, the method and time of gathering should receive the strictest attention, or much of the other labour will be reduced in value. It is not sufficiently recognised how readily all fruits are injured by rough handling. Even hard, unripe, apples and pears are soon bruised, and not only do these marks show as serious defects in the appearance of the fruits, but the keeping qualities are also affected.

One general rule is applicable to all fruits, and that is, they should never, if it can be avoided, be gathered when they are wet, especially if they have to be packed for sending a long distance.

In preparation for sorting, the fruits should be taken and carefully spread on a table or bench, which may slightly slope to the front, and should be of a convenient height for the packer to stand at. The soft fruits must be conveyed to the sorting room on shallow trays or baskets, so that they can be graded direct without turning them out. When experienced hands are employed some degree of sorting can be done at the time of gathering, thus saving further handling or removal of the fruits, and the grower will in every case endeavour to reduce this to the minimum.

Several matters have to be considered in the actual work of grading, and an intimate knowledge of the characteristics of varieties is essential to the best results. The effects of seasons on large crops also demand attention; for the second grade of one crop might rank as the first of an another. It is impossible to lay down a rule that would constitute a standard equally reliable under all conditions, but a general idea can be given of the relative values of different grades under similar circumstances.

The points of importance in classifying the best fruits are :—

(1) Freedom from injuries and blemishes. (2) Good size and even form. (3) Colour. (4) High quality with ripeness.

The first two are essential to all high-class fruits, and no defective, distorted, or undersized samples should be allowed in the leading grades of any kind.

The third quality is a special one, which always possesses a marked value in fruits for dessert, and even amongst some used for cooking or preserving, as in apples, red currants, raspberries, and strawberries, for example. A richly-coloured sample, though only of moderate size, if free from defects will often possess a higher market value than larger and duller fruits. Cox's Orange Pippin, for instance if sold in two grades, one large and dull or greenish-yellow,, and the other a size smaller, but in its best colour, will command the larger price for the latter ; and this is true of many other fruits where colour is a characteristic that is sometimes deficient in the larger sizes.

As regards the fourth point, mere size may also be a secondary consideration, provided the fruits are choice, in perfect condition for immediate use, and free from defects. This especially concerns small packages of dessert fruits, such as the finest pears, plums of the green-gage type, ripe cherries, peaches, and nectarines. A special market must be at command for such samples, or they should be sent direct to the consumers or retailers.

The bulk of fruit grading will, however, be mainly concerned with variations in size, provided the essentials of good form and freedom from defects be secured. It is of the utmost importance to ensure that each grade be as uniform throughout as close attention can accomplish, and then the full value of the work is most likely to be obtained.

A quick eye and some practice under good guidance soon enable a packer to select the various sizes in a uniform manner. Apples in particular can be readily graded into several sizes according to the variety and the crop. Occasionally four well-marked grades may be obtained, in other instance perhaps three are secured, and sometimes only two are obtainable. The difference of a quarter of an inch in diameter will constitute a well marked grade. An American Association has adopted as the minimum standard for first grade apples of the largest types $2\frac{1}{2}$ inches diameter ; while for the smaller types $2\frac{1}{4}$ inches is the minimum diameter for first grade fruits ; in each case a $\frac{1}{4}$ inch is allowed between the firsts and seconds. In practice it is found almost impossible to adhere to such exact grading ; the general standard and range in size of the crop or variety must be judged, and the graduation founded upon this, These remarks especially refer to apples for cooking or desert apples equally well coloured, but what has been already said about the value of colour must be remembered and a special grade selected of uniform size where there is a proportion of larger fruits deficient in that respect.

Most of the details regarding apples are also appropriate to the grading of pears, but as a larger proportion of these are used for eating than cooking, they are more adapted for disposal in small packages, and hence repay the greatest attention in uniform grading. Several

qualities can usually be obtained from one crop, and it generally pays best to sell in two or three grades, only those rejected in the selecting process being disposed of in bulk. Even when large crops from old orchard trees are being dealt with, a few dozens of the finest fruits carefully packed will help to raise the total returns considerably.

Stone fruits may be selected in various grades. Plums for cooking can thus be sorted into two or three grades, the largest fruit commanding the best market. A good medium size is in demand for bottling, and the smaller sizes are utilised in ordinary cooking or preserving. Dessert plums and cherries are readily graduated on the same method, the finest in boxes or small packages and the others in bulk.

Soft fruits, such as strawberries and raspberries, are worthy of equal care, the former being sorted into at least two grades and sometimes into more. The best are placed in punnets, the next in small boxes, and a third grade can be sold in boxes or baskets holding from 6lb. to 12 lb. Raspberries may be conveniently divided into two qualities whenever a special sale can be commanded for the best fruits either in punnets or small boxes.

Nearly oll other fruits also admit of some grading, even though it be only to the extent of excluding defective and malformed specimens: the results yield a satisfactory reward for the labour and expense.

The benefits derivable from careful and systematic grading are by no means confined to fruits, as vegetables also afford considerable encouragement to those who strive to make the most of them in the same direction. Especially is this the case with root crops, though in a general way the sorting adopted is of a very rough character. Potatoes, for example, are usually picked up in three sizes, the large tubers for sale, the seconds or sets, and the small tubers to be used as food for stock. The large size should be again sorted into two or three grades: it is with them as with apples, a comparatively small proportion of coarse irregular tubers spoils the appearance of a large consignment. Even shape and uniformity of sample possess a distinct market value, and a medium sized potato having these characteristics, together with good quality, will bring a better return than huge distorted tubers of which size is the only recommendation. If an extra 6*d.* per bushel or £1 per ton can be secured by such care it often means, with a good crop, sufficient clear gain to more than pay the expenses of cultivation.

A distinction can be made between the best or earliest turnips and carrots and the ordinary quality or crop in bulk, by marketing the former in bunches, while the latter are sent in bags or baskets. Onions, too, can be graded in several ways, the best being bunched or made into "ropes," while smaller sizes are sold loose, the smallest ranking as pickling onions. It is always advisable to have several sizes, each sample fairly uniform, as some buyers have a preference for medium sized bulbs and others for large ones. In selling small quantities by weight the retailers have a difficulty with the largest onions, and usually find a medium size more convenient. If roots are prepared for sale by being thoroughly cleaned it is a great help, and in any case wherever grading is followed all the best qualities should be so treated or the chief part of the labour will be nullified.

Peas and beans should always be graded. Yet this is seldom done by the grower, and, as with many other vegetables, it is usually left to the retailer. Large, well-filled pods of the former are always in demand, and if the colour is good their value is enhanced. But they are too often gathered without due care, and a number of insufficiently developed pods materially lower the value of the whole, while reducing future gatherings. Two or three grades of peas can be readily formed, according, to the condition of the crop and the varieties, some being much more even croppers than others. In supplying consumers direct daily or at regular intervals, it is now becoming the practice to shell the peas, grade them by means of sieves, and consign to the purchaser in small boxes. Dwarf kidney beans and scarlet runners can be graded by selecting the long, straight, and even pods for the best samples, in smaller quantities, the bulk going for sale in bushel or half bushel baskets.

With green vegetables, such as cabbages, savoys, kale and Brussels sprouts the principal point is to see that each sample is uniform and in the best condition, which is largely a question of care in gathering. For ordinary markets the two first named must be large and with solid hearts: for special sale and for sending direct to consumers a smaller size, but possessing all the other essential characters, is often preferable. Brussels sprouts should always be sorted into two grades, all the firmest and most compact into one, and the looser, rougher sprouts into another; the increased price of the first will pay for this in the majority of cases. To cauliflowers and broccoli similar remarks apply; the most even and whitest heads constitute the first grade, the rougher and discoloured the second. As with cabbages, large heads are required in general markets, but for the best sales moderate-sized perfect samples are the most satisfactory.

Other crops pay for attention in the same way. Rhubarb can be classed in two grades, the longest, straightest and best coloured forming No. 1 bundles. Celery may be divided into two or three grades, the heaviest and most solid in bundles for salad, and others loose for soups. Asparagus, too, should be placed in two or three grades, according to the length, substance and blanching: the smallest (Sprue) for soups: all the best in bundles of 25, 50, or 100, the last in larger numbers. Seakale can also be sorted, the best grown and whitest in bundles set upright in baskets.

Tomatoes demand the greatest care in sorting; two, three and even four grades may be formed. The best in boxes or shallow baskets. The most even and brigtest coloured fruits take the lead; there is a special demand for the largest handsome fruits in some markets, but the principal general sale is for good even-shaped, moderate-sized, uniform samples. Cucumbers are graded into two or three sizes; and vegetable marrows are also sorted, but in some places large specimens of the latter are most in demand, while in others a medium size is chiefly required.

Salading, like lettuces and endive, can occasionally be separated into two grades, according to the solidity and blanching of their hearts, but as a rule a uniform sample of one value is preferable, to be regulatedby the gathering.

The essential general rules in grading vegetables of all kinds are the following:—(1.) Exclude all immature, overgrown, coarse, or defective specimens from the leading grades. (2.) Make each grade as uniform as possible. (3.) Let freshness and fitness for use be the characteristics of all vegetables when consigned to market or consumers. To aid in all this only the best varieties obtainable should be grown, and growers should watch closely for every real improvement on old sorts.

Wherever fruits or vegetables have to be transferred a distance by road or rail, the best culture and most careful grading may lose all their value through neglectful packing. That many of the defects in market consignments are either due to this or materially increased thereby the majority of salesmen can confirm, and the complaints on this score are as frequent as those regarding inattention to grading. In dealing with fruits the essentials for success are as follows:—(1) Use only perfectly sound fruits. (2) Pack firmly, without crushing. (3) Use the best elastic odourless materials as packing. (4) Place all choice and ripe fruits in small quantities and shallow packages.

In the home trade baskets are much more extensively used than boxes, and the most common are round baskets without lids, of the bushel, half-bushel, or half-sieve types. They are strong and durable, but are objectionable for all the best fruits as, even with the most careful packing, the top layers are liable to be bruised, and under careless methods they are certain to be damaged. When apples, pears, plums, cherries, or gooseberries are sent in such baskets a covering of paper, with straw or other material, is placed on the top and secured by cross pieces of willow or hazel, the points of which are forced through the sides of the basket below the rim. Flat baskets with lids are preferable but expensive, and the difficulty with all these is that they must be charged for or returned. In expensive dealings with market salesmen baskets are supplied at very little cost to the producer, but where it is desired to promote more direct communication between the grower and retailer or consumer some other method is preferable, or the producer must provide his own baskets. It would be helpful in many districts if a local industry could be developed in cheap basket making; there are few places where suitable willows could not be grown, and the basket making might be performed in the winter evenings. For useful information regarding willows and osiers suitable for the purpose named, see Leaflet No. 36.

Much could be said in favour of boxes for fruits, and, where only small sizes are employed they may be purchased or made so cheaply that they can be included in the price of the fruit, and thus all the trouble of returning or collecting empties is avoided. Their more general use under the right conditions would assist producers to avoid overstocking the markets in seasons of heavy crops, and, by facilitating direct communication with the consumers, secure better prices. In a small way, boxes can be made at home at a cost of $1\frac{1}{2}d.$ to 1*s.* each; on a larger scale, with the use of machinery, they may be turned out at about 8*s.* to 50*s.* per 100, according to the size, and boxes costing 1*d.* to 6*d.* can always be given with the best grades of

fruit, usually even with profit. Many of the leading railway companies have recognised this fact, and now supply boxes of various sizes at 1*s.* 6*d.* to 5*s.* per dozen, while several manufacturers also supply to large orders at very reasonable prices.

Various materials are available for packing purposes, but much the best are the several grades of wood wool now prepared, the coarsest being suitable for large packages and heavy fruits, and the finest softest samples for the choicest and ripe fruits. But wherever it is to be in contact even with apples and pears only the softest make should be employed; and rougher samples can be used for the bottom, or filling up at the top. All choice and delicate fruits should be encircled with bands of folded soft tissue paper, having a glazed surface, which must be in contact with the fruit. This is also required to place over the top layers, but a stronger paper is used for unripe apples or pears.

In the actual work of packing, an even layer of wood wool is placed at the bottom of the box or basket, this being covered with a sheet of paper, and upon it the fruits to be disposed of are placed firmly. The best plums, pears, or dessert apples should never be in more than two layers, and in the smallest boxes holding one layer they travel in the finest condition. If only one layer of fruits is made, the packing material at the bottom, and that at the top, besides the folded paper band round each fruit, will be all that is essential; but if there are two layers, they must be separated by two sheets of paper, and sufficient fine wood wool evenly spread to prevent injury to the lower fruits, and form a firm bed for the upper ones to rest upon. From one dozen to four dozens of the best dessert apples, pears, or plums may be so packed in one box with safety for a long journey. Peaches, nectarines, and apricots must always be in single layers, and demand the utmost care.

Strawberries can be packed in from 3 lb. to 6 lb. of selected fruits, but the first named quantity is the best for the finest fruit, and the smallest of the railway boxes just holds that amount conveniently, allowing for a little packing material at the top and bottom. The same size box will hold 4 lb. of the best cherries, 3 lb. of raspberries without their stalks, 3 lb. red currants (closely packed), or 4 lb. of black currants: but the last two may be packed in 6 lb. to 12 lb. lots if not too ripe; the smaller quantities are, however, preferable and safer. The finest early strawberries should be packed in 1 lb. punnets, which may be either deep or shallow, round-plaited chip punnets, or square ones (with or without handles). The round punnets, are best packed in trays with lids, and those generally employed will take six punnets. They are only used for the earliest and choicest fruits, when prices are good. Crates can be employed to hold several such trays, those large enough for six being a convenient size and weight. The square punnets are packed more closely together on sliding shelves or in trays like the others in crates. Grapes are packed in shallow or handle baskets, the points of the bunches towards the centre and the stalks secured to the sides or rims, the top of the basket being covered with stout paper tied round the rim or some handle-basket are fitted with lids. The sides and base of the baskets are sometimes padded, but they are then always covered with a soft glazed paper. The great point is to avoid rubbing the surfaces of the berries and spoiling the "bloom."

In every case, besides ensuring the security of the finest fruit, it should be displayed to the best advantage, and if the grade is uniform, as advised, this can be done quite honestly by the aid of a little coloured or white tissue paper to fold over the sides when the box is opened, and by arranging the fruits with the coloured side uppermost.

The question of branding or labelling must be considered, for where good fruit is only being dealt with, the use of the words "Seconds" and "Thirds" is apt to give rise to a misconception that is unfairly against the seller's interest. For the finest samples "Extra," "Select," or "Special" may be employed. Some mark the next grade A 1, and the next No. 1, or if the letter X is employed, three would be used for the first grade, two for the second, and one for the third. Another method is to term the best Selected No. 1, and the other grades Selected No. 2 and Selected No. 3. Something of this kind is needed to indicate that the lower qualities are not refuse but probably graded fruits. A grower should adopt a uniform system, and adhere to it, so that his brand may become known and have a market value, and every package ought to have the name of the variety and quality boldly printed on the label. Growers who intend to make a substantial business, and who deal honestly in the best produce, should have their own names on the packages. This is sometimes objected to in a market, but if a grower cannot make his business through the ordinary channels he must try fresh ones. It is best to endeavour to supply the shop keepers, or to develop a trade with private customers, and send direct to them. The reduced rates at owner's risk on the railways, and the parcels post, afford ample means for enterprising men to work up a business in small packages of choice fruits if they take the trouble to do so, either by advertising, by circulars, or by trade letters.

In packing vegetables most of the general advice already given should be serviceable; but these are disposed of in larger quantities and therefore require a different class of packages. Bags of various kinds and sizes, with large light open baskets or crates, are more extensively employed than boxes. The majority of roots are sent in bags, but the best samples of turnips, carrots, &c., that are bunched are sent in crates, while radishes and small roots are sent in baskets. Green vegetables, like cabbages, are best in crates, as also are broccoli and cauliflowers, but the earliest and best of the last named are often packed in flat baskets or hampers and pay for every care. The best samples of salading, such as lettuces, are usually packed in hampers, the rougher grades in crates. Peas and beans are packed in baskets, bushels, or half-sieves, but as previously noted peas when shelled are forwarded in small boxes containing about three quarts each. Half-sieves are also used for Brussels sprouts, pickling onions, and other small vegetables. The earliest rhubarb is consigned in hampers; the later often goes to market in bundles loaded direct into the vans, or packed in crates, as also is celery. For all early and high quality vegetables shallow baskets or boxes are useful. Cucumbers, tomatoes, mushrooms, and many others can be conveniently sent in this way, and where periodical consignments of general vegetables are sent to private customers this is the best method. It is neccessary to pack firmly as with fruits, and where green or perishable vegetables have to travel a long distance it is desirable to gather them as shortly before

packing as possible, preferably in the early morning when quite fresh, but not when drenched with rain. They should not be allowed to remain exposed to sun or wind for some hours before they are sent off, as it is sometimes the case, to the obvious disadvantage of the seller. Defective or decaying samples should on no account be admitted into the packages; the uniformity so strongly recommended as regards fruits should be maintained, and it will be found that the reputation gained is a satisfactory reward for the extra care.—*Board of Agriculture*, 4, Whitehall Place, London, S.W., Dec., 1903.

612—FIGHTING "BLACK POD" ON CACAO ESTATES.

In the year 1898, the Cacao pod rot known as "Black pod" or black Cacao, was very prevalent on Cacao estates.

The attention of the Botanical Department was called to the fact, and an investigation showed that the pods were blackened or destroyed by a fungus determined as *Phytophthora omnivora*. Among the remedial measures advised were the burning or burying of all empty pods from the "breaking places"—(*i.e.*) from the places where the pods are broken open and the beans extracted. Formerly these were allowed to rot on the ground with the result that healthy trees were soon infected and from the trees near the "breaking places" little Cacao was obtained. The Agricultural Instructors report that throughout the Colony attention is being paid to this matter, and that the system of burying the broken and diseased pods is gradually coming into use. To demonstrate the infectious character of the disease to unbelievers, it has been necessary in some cases to perform infection experiments on the lands of the cultivator. Where this has been done it has been readily recognised that our recommendations are of importance and the system of burying the pods has been adopted. In several cases, on large estates the system has been voluntarily adopted by the proprietors with the greatest benefit, and quite recently the Department was thanked for its efforts by a proprietor of a large estate who declared that our recommendations had saved him 20 to 25 per cent. of his crop in the early parts of the year, 1904. Such results are eminently satisfactory and we would earnestly urge those who as yet have not adopted burying pods, to try the process, which we are now quite sure will repay the grower ten times over for the money expended on the work. "Example is better than precept." We have recently seen the effect of example on the Government Estate at Diego Martin, where the practice it is now regularly carried out by the peasant after a sight of an inoculation experiment proving the infective character of the disease.

For the benefit of those who have not yet adopted the method it may again be briefly described.

In all cases where pods are broken on the field, the empty pods should be buried within twenty-four hours after "breaking," in trenches made from twelve to eighteen inches deep. In these trenches pods should be piled and covered up with earth to a depth of at least 4 inches. It is also well to go through the field at frequent

intervals and remove any pods large or small, seen to be diseased and bury them at once, in the same way. If quick lime is available, a quantity should be sprinkled on empty pods before covering with earth.

613—TREATMENT OF WOUNDS CAUSED BY BAD PRUNING IN CACAO PLANTATIONS.

In Cacao plantations under the old system of cutlass pruning, snags or stumps have been left with jagged edges. Into these spots, spores of various wood-destroying Fungi readily find their way, with the result that decay sets in rapidly, and wood ants take up a position therein, eating away the decayed wood, and leaving large holes in the stem to the depth of several inches. Water enters these holes and tend to decay the wood more quickly by its presence, and eventually the decay reaches the heart of the tree, and it gradually dies out. It is certain that more trees are lost by bad pruning on a Cacao estate than from any other cause. In pruning cacao, all branches should be removed close up to the stem and no snags, spurs, or projecting stumps should be left, but any branch removed should be cut close, the surface of the cut being made in a proper direction to shed water. It should then be pared with a sharp knife or other tool to make it smooth, and a little tar applied as a styptic or antiseptic dressing. If this is done the edges of the wound will rapidly close over and completely shut out moisture and all rotting will be stayed. In cases, however, where holes exists in the stem, they should be carefully cleaned out and filled up with Portland cement and sand mixed in the proportion of one of cement to three of fine clean sand. This will effectually stop the hole and prevent the entrance of water, and will save the life of many a valuable tree.

The suggestion may be dismissed by some as being too expensive, a little calculation of the cost and value of a tree, will I think prove to any reasonable mind, that it would be money well expended. At any rate, it is hoped this notice will persuade planters to try it a little at a time, as there can be no doubt of the ultimate result.

It is to be remembered that large cultivations like cacao, are sure sooner or later to be attacked by disease, and in Cacao plantation, as in cities, it is the cleanest and healthiest that escape, and not those, where neglect of Hygeinic measures is but too apparent. So it will be with Cacao, a clean and healthy tree is much less likely to be attacked than one in a half starved, and neglected condition. Tar all wounds therefore and prevent entrance of disease and the rotting of stems to the heart, and if neglect of pruning is apparent, by holes in the stem, have them filled as soon as possible with cement composition.

614.—SEA ISLAND COTTON.

By Sir Daniel Morris, K.C.M.G., and J. R. Bovell, F.L.S., &c.

In part No. 4, of the fourth volume of the West Indian Bulletin, issued by the Imperial Department of Agriculture for the West Indies, there is gathered a collection of information on this subject which

cannot fail to be of the greatest use to all entering into cultivation of Cotton in the West Indies, and we commend the number to our readers for careful perusal. The cost is sixpence per copy and it can be obtained of agents or direct from Messrs Bowen & Sons, Barbados.

No one who intends to go into the cultivation of Cotton should be without a copy of this excellent and valuable number of the West Indian Bulletin.

615.—PALMAROSA OIL GRASS.

The following information by Dr. Otto Stapf, has been kindly furnished by favour of Sir William Thistleton-Dyer, Director Royal Gardens, Kew, in response to our enquiries :—

Three distinct essential oils are produced from species of Andropogon in India :

1. *Citronella oil* from A. Nardus.

2. *Lemon Grass Oil* (or Verbena Oil or Indian Melissa Oil). This is usually attributed to A. citratus, DC. It is, however, impossible to find out what De Candolle meant by his A. citratus as he never described the plants, and merely said " folia trita citri odorem grate spirant" and " habitu fire Andropogonis Schoenanthi sed major." Later writers (Dymock, Flückiger and Hanbury, Watt) applied the name A. citratus to the grass yielding Lemon Grass Oil, but without describing the grass, (except quite vaguely as a tall, coarse, glaucous grass). Several specimens in our herbarium marked by the collectors as yielding Lemon grass oil or a Lemon grass oil, are typical A. Schoenanthus L., and there is practically no doubt that the A. citratus of the *later writers* is identical with A. Schoenanthus L., whatever A. citratus DC. may be. In any case the name A. citratus will have to be dropped as ambiguous.

3. *Palmarosa Oil.* (Rusa oil, Ginger Oil or Geranium oil). This is produced principally in the Kandesh (Khandesh) collectorate and in the Nimàr district. Dymock (Mat. Med. West. India ed. II 848) refers the grass yielding this oil to A. Schoenanthus, quoting A. Martini, Roxb. and A. citratus, DC., as synonyms. His description of the plant is, however, so vague that it is useless. If the assumption that A. Schoenanthus, Linn. is the source of the Lemon grass oil is correct, the Palmarosa oil grass, must be produced from a species other than A. Schoenanthus or a variety of it, distinct from the typical form. Which that is, we do not know at present.

To settle this important question, it appears to be very desirable to have well collected specimens of this grass from the Khandesh or Nimar district.

OTTO STAPF.

16th February, 1904.

616.—PIG BREEDING AND FEEDING.

To manufacture a first class carcase of pork from an ill-formed badly-bred pig is almost as difficult as "to make a silk purse out of a sow's ear." The selection of the parents of the castrated boars and spayed sow pigs which are to be fattened is, therefore, of vast importance. Where possible, it is best to obtain the service of a pure-bred boar, which should be of good quality and of a quiet disposition, fine in bone and hair, lengthy and deep in back and hind quarters, and with a comparatively light fore end. The brood sow should possess as many of the above points as possible, with at least twelve teats, placed as nearly as possible equi-distant from each other and commencing close behind the forelegs of the sow.

Many persons consider that the purity of the breed of the sow is not so important, but, as with the boar, pig breeders cannot be too strongly urged to keep for breeders only those young pigs which are the produce of prolific, good tempered and free suckling sows. Far too little attention is frequently paid to these three most important points. Old pig keepers have observed that the produce of sows that farrow large litters of even sized pigs fatten more quickly and require less food for a given increase in weight; and it is also a fact that the produce of the more lusty and muscular sows, which are usually in good condition, are better growers and strivers than the pigs of smaller litters from weakly and delicate sows. Matured sows will produce a greater number of pigs, which are often more thrifty in many ways, than will the young sows which are too early mated with the boar.

It should be remembered also that sows continue to produce good pigs for several litters. Considerable attention is at the present time being given to the system which is common in some of the northern counties of rearing but one litter of pigs and then fattening the sow. One of the reasons given for this plan is that the young sow when fattened will take the place of a fat castrated male or spayed female pig, and thus realise more per pound than would an aged sow when fattened: also that in these districts the majority of the pigs are fattened within a certain few months, and, therefore, it would not pay to keep the older sows to produce only one litter per year. Neither of these reasons appears to have much force, since it is generally acknowledged that the most successful pig feeder is the one who has fat pigs to sell at all periods of the year, but particularly in the months of July and August, as the highest price is then generally obtained for pork, whilst it has cost less to produce, since much less food is required to produce a given quantity of pork in warm than in cold weather. It has been proved in the United States that in very severe weather the whole of the nutriment contained in the food is required to keep up the animal heat of the pigs, so that no increase of weight is made. Of course, the cold in this country is not so severe, but the loss sustained by low temperature and damp weather is far greater than is generally believed by pig keepers.

Again, a well-matured sow will rear at least 20 per cent. more pigs at less cost per head than will most young sows with their first litters: besides this, the proportion of runts or weakly pigs will be smaller.

The system of killing off all the young sows also makes it impossible to improve one's stock of pigs by reserving the future breeding stock from the litters of the sows which have proved themselves to be superior milking sows and the most prolific. These are two qualities which are of the greatest importance, but which can only be discovered by the actual results of two or three litters from each sow. The continued selection by certain breeders of the best pigs from such sows has rendered their pigs superior to those in any part of the world.

There exists considerable difference of opinion as to the type or style of pig most generally profitable. The first point to be considered is the market which the pig breeder proposes to supply; in some districts near London and some other large towns the chief demand is for pigs of some four to five months old and weighing about 60 lbs. dead weight, or some 85 to 90 lbs. alive. The Middle White Yorkshire sow is much kept, and crossed either with a boar of the same breed or a Berkshire; some persons prefer to cross the other way, but the pigs from the Middle White sow are generally more numerous and grow faster when young. Many hundreds of this type of fat pig are now being weekly imported from Holland and Belgium for the London market, the Middle White boar being used on the larger native sows and the Large White boar on the more compact sows. There appears to be no sufficient reason for our pig breeders neglecting this profitable trade.

The form and weight of the fat pigs required in other districts varies from the so-called bacon curer's pigs of some 160 lbs. dead weight to the 220 lbs. to 300 lbs. somewhat fat pig most in demand in parts of Yorkshire, Lancashire, and other counties. Very much the same type of pig is needed to furnish both classes of fat pigs The finer quality Large White is the more general favourite, but in some districts the Berkshire and the Tamworth pigs, both pure and crossed, and the Large Black pigs of the two different types which are to be found in Cornwall and Essex, are preferred. Consumers generally are now much more particular as to the quality of the pork which they purchase, so that those pigs which furnish the greatest proportion of the higher-priced joints are the most profitable to breed and to fatten, particularly if they are also less expensive to keep.

In some districts certain varieties or crosses of pigs are more generally kept since the residents consider that they thrive better than any other breeds or kinds. They may be some little ground for this belief, but a really good type of pig will thrive just as well in the north as in the south of these islands. Soil and climate undoubtedly affect cattle and sheep to a considerable extent, since the quality and quantity of food is effected by the soil and temperature of a district, whilst the latter especially affects the conditions under which the cattle and sheep are kept: but with pigs the majority are housed and fed on similar food in most parts of the country.

The term of life of the fat pig should also be so short that the climate cannot materially affect its growth and thrift, or, in other words, the life of the pig should consist of only one part, the fattening period, not, as is too far frequently the case, a long store period, to be followed later on by a more or less long time in being fattened.

An enormous loss is sustained by the adoption of the second system, as after the pig has arrived at some three months old, the cost of producing a pound of meat from it will gradually increase, so that a loss results after a few months. The cause of this is not far to seek : the young and growing pig can and does utilised all the properties of the food, so that the growing and feeding progress simultaneously, whilst the older and store pig really needs only those properties of the food which are required to fatten it, so that the other properties not utilised are simply wasted. Besides this a certain quantity of food is required simply for its upkeep, so that if the pig lives only a month longer than is absolutely necessary the value of this amount of food is thrown away.

It has always been, and perhaps it will continue to be, a moot point as to whether it is more profitable to breed pigs and then sell them when they are about eight or nine weeks old, or to keep them for some six months and then sell them as strong stores, or to breed and fatten them. If in the past the latter plan appeared to lend itself best to the realisation of a profit from pig keeping, the present conditions certainly favour this system : besides this, the middleman's expenses and profits, the loss of condition in flesh, and the risk of disease and illness, are all avoided when the pigs are both bred and fattened in the same place. Improvement of the pig stock of the country is also much more likely, as the breeder and feeder is given a strong incentive to so breed his pigs that they will grow more quickly and fatten more readily, on a smaller quantity of food ; whereas, if the system of selling the pigs as stores is followed, the chief aim of the breeder will be to produce pigs which appear to be big for the money, pigs which are long in the legs, coarse in bone, and generally deficient in quality.

The best system of management of sows and young pigs varies with the district. There is often a considerable quantity of available food which costs little, be it odds and ends from the garden and the house in the country, or from hotels or public institutions wherever they may be found. In many, if not in most, instances, the sow may be kept at little expense during the three months after her pigs are weaned—a run in a paddock or grass field during the spring and summer will be well nigh sufficient : then, when the grass loses its quality, or becomes less in quantity, the addition of a few peas, beans, or soaked maize, or even roots of almost any kind given raw—potatoes only being steamed or boiled—will suffice. Even the kitchen refuse from fair sized houses will go far towards the keeping of the brood sow. During the latter stage of pregnancy the sow must be fed on more nourishing diet, since the drain on a sow is very considerable in the production of a good litter.

In the majority of cases the farrowing sow needs but little help. So few of the ordinary sows kept are accustomed to the owner or attendant taking much notice of them that they will probably resent the offers of help when the pain and excitement attending farrowing render the sows more sensitive and nervous. There may be times when a little help is needed, as when one of the little pigs is presented doubled up, as sometimes occurs ; then the attendant's hand should be well greased and carefully inserted, so that the pig be returned into the womb, when it will most probably be rightly presented

and brought into the world. Again, piglings which are of abnormal size from any cause sometimes gives the sow considerable trouble to eject. If the sow be perfectly quiet, help can be given with profit by the attendant, care being taken not to use too much force so that the sow is not internally injured.

After the sow has finished farrowing, a small quantity of warm and sloppy food should be given to her, and if the bed is very wet, a small quantity of short straw should be given to her, when she will lie down and rest for several hours until her pigs are quite strong, providing they do not quarrel over the selection of their own particular teats ; if they should bite the sow's udder, the little sharp teeth should be broken off with a pair of pincers. Those pigs which are carried more than the usual sixteen weeks frequently have long and sharp, and sometimes dark coloured, teeth, which are very sharp; to break these off is a necessity. The sow will usually show that the pigs' teeth require attention, as she will lie on her belly and refuse to suckle them ; if this be continued for any length of time the collection of milk will cause inflammation of the udder, with disastrous results.

When the pigs are about a month old they will commence to eat some of the sharps fed to the sow ; it is then a good plan to turn the sow out of the sty for an hour or two, and to give the little pigs a few peas or kernels of wheat to eat. Many persons make the mistake of only feeding the freshly weaned pigs twice a day, forgetful of the fact that the sow suckles her pigs from eight to twelve times a day, as they grow older. Their stomachs are not intended to stow away large lots of food at a time.— *Board of Agriculture*. 4, Whitehall Place, London, S.W., January, 1904.

617.—RELATIONSHIP OF WOODS TO DOMESTIC WATER SUPPLIES.

This subject has, for more than twenty years, occupied much of the attention of Forest Experimental Stations, especially in Germany, France, Austria, and Switzerland : and in view of its importance the conclusions arrived at may be usefully summarised.

It has been asserted, and theoretically the contention is doubtless correct, that masses of woodland increase the rainfall. The causes of this result are sought for in the reduction of temperature associated with forests, and in the greater absolute and relative humidity of the air in woods. But although it may be possible to obtain experimental proof by means of elaborate and long-continued observations in a region where extensive afforestation or deforestation is taking place, it may at once be said that such tree-planting as is practically possible in Britain can have no appreciable influence on the rainfall. Trees do, however, under certain conditions of the atmosphere, condense dew on their leaves and branches, and this effect may often be seen in the wet state of the ground underneath trees on a foggy morning, when the surface elsewhere is comparatively dry.

But the case is materially different where the fate of the rain and snow that falls on a tract of woodland is considered. The foliage, branches, and stems of the trees intercept much of the rain and snow so that it never reaches the ground at all, the amount so intercepted

usually ranging from 30 to 45 per cent. of the total, but much depends on the character of the rainfall, and on the species of tree. In a district of heavy annual rainfall a smaller proportion of the precipitations is caught by and evaporated from the trees than where the rainfall is light. Similarly in the case of heavy and long-continued rain, as contrasted with gentle showers: in the latter case, in fact, but little of the water reaches the ground through the leafy canopy of a dense forest Then again much depends on the kind of tree, evergreens intercepting more water throughout a year than deciduous trees, and a larger proportion of the rainfall is evaporated from the leaves and branches in summer than in winter.

But although less rain-water reaches the soil of a wood than finds its way to the ground in the open country, the moisture in the soil is much better conserved in the former than in the latter case. Long-continued observations have shown that more water drains from a wooded area than from one devoid of trees. The greater abundance of water in forest soil, in spite of the trees intercepting a large proportion of the rain-fall, is due partly to the reduction of evaporation owing to the exclusion of the sun's rays by the foliage, partly to the reduction of evaporation owing to the exclusion of the sun's rays by the foliage, partly to the air in a forest being more humid, and thus better fitted to discourage evaporation, and partly to the absorbent and retentive character of the decaying vegetable matter that covers the ground of a dense and well managed wood. The lace-work of tree roots, too, that occupy the soil of a forest, offers mechanical resistance to the rapid surface-flow of water. It is also to be noted that roots penetrate to great depths, and when they die they leave holes through which water readily penetrates from the surface. The friable condition of the soil of a wood, too, permits ready percolation of water, whereas in the open country the denser character of the surface of the ground is less favourable to the entrance of water. The consequence is that streams in a wooded country are not so subject to rapid rises and falls, the flow being maintained more equably throughout the year. Where water supply for domestic or industrial purposes is concerned, the avoidance of violent freshets on the one hand, and scanty flow on the other, is alike desirable. Not only may the water of sudden and heavy floods be lost owing to the incapacity of the reservoir to contain it, but such floods have also the disadvantage of carrying much mud and similar material in suspension, and this gradually silts up reservoirs, besides entailing increased expenditure in filtering

It may be pointed out that the water of a reservoir surrounded by well stocked woodland is not subjected to the same amount of violent agitation during gales as is the case when such sheltering agency is absent. The mud and silt deposited on the bottom, and especially along the margin, is consequently left comparatively undisturbed, with corresponding advantages in the matter of purity.

When a catchment area is covered with trees, and with the vegetable matter that accumulates on the surface of the ground, the water that reaches the soil as rain is impeded in its flow, and its evaporation is hindered, so that the general effect is equivalent to an increase in the size of the reservoir. It is also important to note that snow melts more slowly underneath trees than in the open country,

so that at a time of thaw the snow-water is yielded up more gradually. Nor must the fact be overlooked that when snow in a forest melts, the ground absorbs the water to a much greater extent than happens in the open country. In the latter case the ground is probably frost bound, so that the snow-water cannnot be absorbed by the soil, whereas forest soil, being protected by, trees, never freezes to the same extent, and is consequently in a better position to absorb snow-water. The result is that not only does a forest mitigate the violence of floods, but the snow water that flows from its area is less muddy than would otherwise be the case.

Forests not only affect the degree of moisture in soil, but they also exert considerable influence on the soil temperature. Although this influence is greatest at the surface of the ground, it is also perceptible to a depth of several feet. On the average of a large number of continental stations it was found that woods of various species and ages depressed the mean annual temperature at the surface of the ground by about 2·6° F., while even at the depth of four feet the reduction of temperature was 2°.

This general cooling influence is due to a variety of causes. The foliage of the trees excludes the sun's rays, the decaying vegetable matter that covers the ground prevents the free exchange of air between the soil and the atmosphere, while the water in the soil absorbs much heat without its temperature being much affected.

While woods have a depressing influence on the mean annual temperature, it is found that this effect is much greater in summer than in winter. On the average of 11 German stations the July temperature of the surface soil in the forest was found to be 7° F. lower than that in the open field, whereas in December the former was rather warmer than the latter. Forests, therefore, tend to equalise the temperature of water collected in them, the temperature being slightly raised in winter, and markedly reduced in summer. This result would appear to be of considerable practical and hygienic importance where a supply of water for domestic purposes is concerned.

To the credit of forests is also to be placed the fact that they exercise a purifying influence both on the air and on the soil, germs of all kinds being markedly scarcer in a well-wooded district than in a similar extent of tree-less country.—*Board of Agriculture.*

4, Whitehall Place, London, S.W.,
January, 1904.

618.—AGRICULTURAL GEOLOGY.

There is a considerable want of knowledge of the elements of Geology, especially the formation of the superficial crust of the earth, among many of the followers of agriculture in the tropics. So far as our knowledge goes there is no book which treats specially on the soils of tropical countries, but there has recently been published by Methuen & Co. (1903) a very valuable treatise of 318 pages for the use of candidates for the International Diploma of Agriculture which appears to be well suited for the guidance of students in all countries. The author is J. E. Marr, M.A., F.R.S., Fellow of St. John's College, Cambridge, and its price is within the means of the humblest.

The author states in his introduction that "the geology of the British Isles is, to a great extent, an epitome of the geology of the world which shows us that the books will be valuable to Tropical Students as to those of other climes. It is to be highly recommended for the use of classes in practical Agriculture.

The practical Agriculturist will be all the more fitted to compete with his fellows if he knows the elements of Botany, Entomology, Physics, Chemistry, Mechanics, Hydraulics, Natural History and Geology, and no simpler or better work for obtaining information on the latter subject can be found than Marr's Agricultural Geology, Methuen & Co. 1903.

619.—SESAMUM INDICUM.

Enquiry has come to hand for seed of this plant for the purpose of Manufacturing Oil. In good seasons the plant appears to thrive very well, and it is quite possible that it would prove a remunerative crop, and one specially suited to small cultivators. A trial plot will be opened at St. Clair during the ensuing season. It is hoped that reliable information will be to hand as to prices in time for the next issue of the Bulletin.

620.—PRODUCTION AND MANUFACTURE OF VANILLIN AS A SUBSTITUTE FOR VANILLA.

Imperial Institute,
(South Kensington, London, S.W.)

Vanillin is the constituent to which vanilla owes its aroma and flavour. It was discovered in 1858 by Gobley, and was subsequently investigated by a number of chemists, notably by Tieman, who first prepared it artificially from coniferin, a glucoside found in certain coniferous plants. Since that time a large number of processes for the artificial preparation of vanillin on a commercial scale have been devised. The first of these to meet with commercial success was that of De Laire (English Patents: 1890 No. 17547: 1891 No. 17137), who used as a starting point *eugenol*, the substance to which oil of cloves owes its characteristic odour. De Laire's process, either in its original form or slightly modified, was worked in France by De Laire & Co., and in Germany by Haarmann and Reimer during the period 1891–1896, apparently under an agreement to avoid competition in prices. About 1897, however, a period of competition set in between the French and German makes, which was further accentuated by additions, in France, Germany and Switzerland, to the number of firms making vanillin. The result has been that the price of this product, which was £9 per lb. in 1890, has steadily fallen until in November last it was quoted at £1 1 4 per lb. It is probable that all the vanillin so far placed on the market has been made from eugenol, and its price has therefore been governed by that of oil of cloves as the raw product. In 1901 however, a patent (No. 310,983) was taken out in France by Vigne, in which an electrolytic method for the preparation of vanillin from sugar was described. If the

claims of the inventor are borne out by practical trials on an industrial scale, it is probable that a further reduction in price may be expected, owing to the great difference in cost of the two raw products eugenol and sugar.

There is no trustworthy information as to the extent to which artificial vanillin is manufactured and used at the present time, but to judge from the number of firms engaged in its production the amount must be considerable.

As regards the effect of the manufacture and sale of "artificial vanillin" upon the demand for vanilla, it is remarkable that this has up to the present been comparatively slight. When it is considered that vanilla is employed principally as a flavouring agent, and that its value in this respect depends upon the amount of vanillin it contains, it is curious that so recently as November last good qualities of vanilla should be saleable at 17/- to 19/6 per lb., whilst the equivalent amount of artificial vanillin for flavouring purposes, could be obtained for about one-thirtieth of this cost. It is probable that this preference for vanilla over artificial vanillin is due partly to conservatism on the part of the consumers, and partly also to a somewhat widespread belief that vanillin does not wholly represent the flavour of vanilla, which it is alleged is partly due to minute quantities of other aromatic substances present in the plant. Some evidence in favour of this view is furnished by the statements made at various times by chemists who have examined particular varieties of vanilla, and have isolated in addition to vanillin small quantites of heliotropin, benzoic acid, etc. These substances are however both cheap and readily obtainable, and if necessity arose it would be a very easy matter to mix them in a proper proportion with vanillin, in order to modify the flavour of the latter in the required direction.

The foregoing statement of the present condition of vanillin manufacture indicates clearly the possibility in the near future of the replacement of vanilla as a flavouring agent by vanillin.

It is difficult to obtain reliable statistics of the production of vanilla since the cultivation of this product is so widley distributed in tropical countries, and the imports of it into the principal consuming countries are comparatively of so little value that they are rarely separately given. The United States Trade Returns for 1902, however, give a table of the imports of vanilla into that country for the decennial period ending in 1902, of which an abstract is given below.

Imports of Vanilla into the United States of America.

	Weights. lbs.	*Value.* $	*Average value per lb.* $
1894 ...	171,556	727,853	4·2
1896 ...	235,763	1,013,608	4·2
1899 ...	272,174	1,235,412	4·5
1900 ...	225,966	1,209,334	4·7
1901 ...	248,988	875,229	3·5
1902 ...	361,739	859,399	2·3

These figures show that although there is at present no falling off in the demand for vanilla, there has been a great decline in value.

The same state of things is shewn by the results of the two auctions held in London in February and November, of the present year. At the former, 2,800 tins were sold and at the latter 1,410 tins. These quantities are in excess of those of former years. The prices obtained in February, ranged from 22/6d., per lb., for best qualities to 14/6d., for somewhat short chocolate coloured beans, and 7/6d. to 11/6d., for "foxy brown" beans. In November the best qualities realised only 17/- to 19/6d., per lb., short beans from 8/6d. to 11/- and poor qualities 4/- to 7/- per lb.

It is almost impossible to give accurately the total annual production of vanilla at the present time, but it may be estimated at about 350 tons, of which about 150 tons are produced in the British Colonies and Bourbon, and the remainder in Mexico. Such statistics as are available indicate that the total production has remained almost stationary during the last few years, the increased out-put from Seychelles and Mexico being compensated by smaller exports from Mauritius and Bourbon. This being the case it is evident that the depreciation in value of vanilla must be ascribed almost entirely to the competition of vanillin as a flavouring agent. In this connection it is desirable that it should be known that the so-called "artificial vanillin" is identical in every respect with the vanillin contained in vanilla, and to which the flavour of the plant is chiefly if not entirely due. For this reason it is not possible to encourage proposals to prevent the sale of vanillin as a "substitute" for vanilla.

(Sd.) WYNDHAM R. DUNSTAN.

29th December, 1903.

This Report would appear to be a serious blow to the cultivation of Vanilla in Tropical Countries.

J. H. H.

BOTANICAL DEPARTMENT.

BULLETIN

OF

Miscellaneous Information.

(QUARTERLY.)

JULY, 1904.

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Edited by the Supt. Botanical Department:

J. H. HART, F.L.S.

TRINIDAD:
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621.—WHAT'S IN A NAME.

TRINIDAD contains a mixed population speaking different languages. We have English, Scotch, Irish, French, German, Spanish, Chinese, Hindostani and various other Foreign nations are represented in lesser numbers. The chief languages spoken are English, French and Spanish and besides these, both French and Spanish *Patois* are spoken by the lower classes. Different languages, spoken in one place are always found to give rise to the coining of new words and especially is it so, in Botanical matters relating to the various plants and trees, and in many cases it is found to entirely change the meaning of the original name. For instance take the fruit known as *Jambosa vulgaris* D. C. This is known as the "Rose apple" in the English tongue. In French, it is known as "Pomme Rose" the equivalent for the English. Now the uneducated English speaker after hearing it called "Pomme Rose" in French or French Patois, instead of using the word Pomme converts it into "Plum Rose," and as Plum Rose, it is now known by the English speaking lower class. Again *Jambosa malaccensis* D. C. is known as "Pomme Malac" in French Patois, but in English this French name is converted into "Pomerac" or "Pomerack." The fruit of *Lucuma Mammosa* is known in the French as "Sapote," in Jamaica as the "Mammy Sapote." While in Trinidad the fruit called "Mammy Sapote" is entirely different, being that produced by "Mammea Americana" a fruit not in any way nearly related to the former. The fruit of *Sechium edule* is known to Jamaicans as Chow Chow, to Trinidadians as "Christophine." The fruit of *Solanum Melongene* is known as Egg Fruit to English people; to West Indians it is known as "Belangene," "Melongene," "Belle-et-Jeune" and various other names. A long list of like variations might be quoted, but the moral appears to be, that where, the local names used for one thing are not alike, and when it is necessary to have a certain plant correctly indentified, this can only be done by use of the correct scientific or Latin name under which it is recognised by Science. In fact there is nothing reliable in any local name, as it is proved to be subject to change in different countries, in different districts and even in small communities there exists considerable variations in the names of plants and fruits. A Rose with a Latin name however would "smell as sweet," and a fruit would taste as good, and both would be more easily identified, were it to be regularly used in cases where accuracy is of importance.

622.—HINTS ABOUT ROSES.

USEFUL HINTS ON THE SUCCESSFUL GROWING OF ENGLAND'S NATIONAL FLOWER.

Do not prepare rose beds in wet weather.

Don't plant a rose tree where it is likely to get a great deal of wind.

When rose trees are affected with mildew flowers of sulphur should be sprinkled over the leaves.

The budding of roses should be done either early in morning, or in the cool of the evening.

Prune when they are resting during dry weather.

Rose trees will not do well in places where they are overhung by branches of forest trees.

When making a rose bed do not raise the soil too high, otherwise the moisture will run off, causing the trees to suffer.

The roots of Rose trees growing on a wall should be watered in dry weather. The wall prevents showers reaching them.

When planting roses dig the hole large enough, so that the roots will not be cramped. See that the soil is well stamped down and the trees stand firmly in the ground.

Directly any green fly are seen on a rose tree a strong sousing of water should be given them with a syringe. A more effectual way of destroying them is to remove them by hand.

Syringe rose bushes frequently, as it is much better to prevent green fly than to try to cure it when it has a hold.

Unless the seed vessels or pods of a rose are known to be unusually pretty they should not be allowed to form, for it weakens the plant, and tends to make the flowers smaller and fewer in number.

Rose trees breathe through their leaves, which must therefore be kept clean. In towns they should be frequently syringed with clean water, with sufficient force to wash all the dirt away.

October and November are the best months for ordering out rose trees which should be obtained, if possible, from nurseries in Europe or America. Do not buy grafted plants, but plants struck from cuttings or as the growers say, "on their own roots."

The best soil for roses is composed of two-thirds loam and one-third manure, the whole being well mixed and stamped down so as to be fairly firm. The depth of soil should be at least a foot and a half.

In light soils roses should be constantly renewed, as this is the only way to have good flowers in abundance, the reason being that there is no staying power in sandy soil, and the trees soon exhaust it.

In dry weather rose trees should be thoroughly drenched at least once a week, and all the time they are blooming a little guano should be mixed with the water, or scattered on the soil, and then watered in.

As soon as it is seen that a leaf or two of a rose tree is curled right up, a maggot must be looked for, and when found, either burnt or thrown into strong salt water. These pests must always be removed at once, otherwise they increase very rapidly, and cannot easily be eradicated.

After unpacking a newly bought rose tree cut off all the dead tops of the shoots, and also any roots that looked mangled, taking care not to pull off the fibrous portions (tiny rootlets attached to the main roots), as these will take hold of the new ground, and keep life in the tree.

The propagation of roses by seed is not recommended, owing to the length of time one has to wait for any result, but it is not a bad plan to increase the stocks by cuttings, and these should be taken about nine or ten inches in length, and planted deep in a shady border or *pot* and the earth firmly pressed round the shoots.

623.—RESIN from *Clusia alba.*

This resin was collected by a friend from trees growing on one of the Quarantine Islands in the Gulf of Paria (Harbour of Port-of-Spain.)

IMPERIAL INSTITUTE OF THE UNITED KINGDOM, THE COLONIES AND INDIA.

No. 346/13. Imperial Institute Road, London, S.W.,
18th May, 1904.

Dear Mr. Hart,

The small sample of Aralee or West Indian Gamboge derived from *Clusia alba*, Linn, which you forwarded to the Imperial Institute on the 8th April last has now been examined in the Scientific and Technical Department and has given the following results.

The specimen weighed about 75 grams and consisted of Small lumps of a brittle resin varying in colour from light yellow to deep reddish brown. The material was soluble in choloroform, ether, benzene and oil of turpentine and partially so in alcohol. It melted at 74° C. and on ignition furnished 0·45 per cent of ash. The saponification value was 151·5, acid number 128·5 and ester value 23·0.

These results indicate that this resin is quite unlike commercial gamboge in composition. Its solution in turpentine oil when exposed to air dries slowly to a soft sticky varnish which would be of no use for technical purposes. It is improbable that this resin possesses any commercial value.

I am,

Yours faithfully.

J. H. Hart, Esq.,
Botanical Department,
Trinidad.

Wyndham R. Dunstan.

624.—REPORTS BY PROFESSOR DUNSTAN ON CACAO COTTON AND HONEY.

IMPERIAL INSTITUTE, (south kensington, london, s.w.)

Report on Cacao, Cotton and Honey from Trinidad.

By Professor Wyndham R. Dunstan, M.A., F.R.S., Director.

These samples of cacao, cotton and honey were forwarded to the Imperial Institute by the Governor of Trinidad, and are referred to in the letter from the Colonial Secretary, No. 1565/545 of the 11th March, 1904, in which it was requested that they should be submitted to examination and valuation by the Scientific and Technical Department. The specimens had been prepared by the Superintendent of the Royal Botanic Gardens, Trinidad, and particulars concerning them were supplied in a separate communication.

Cacao.

Two samples of this product, labelled No. 1 and No. 2 repectively, were received for examination, and they are stated to have been grown and prepared at *River* Estate, Diego Martin. No. 1 was a "select" sample which had been valued locally at $14 per 110 lb., and No. 2, described as "Good ordinary," was priced at $13 per 110 lb. in Trinidad. The specimens were considered to represent the finest types of Trinidad cacao, and had been very highly commended in the Island. It was therefore desired to submit them for valuation and criticism to English buyers.

The favourable opinion which had been expressed in Trinidad regarding the samples was fully confirmed by their appearance, particularly in the case of No. 1, which was a very fine specimen of cacao. Both varieties were submitted for valuation to leading brokers, who have furnished the following report.

No. 1.—This is described by the brokers as bold, selected cacao of good appearance, apparently well-cured and fermented. The sample is stated to compare very favourably with the finest specimens of cacao from the leading Trinidad estates. Its value in the London market at the present time is estimated at 75s. to 77s. per hundred weight in quantity, but for a few bags only, if every bean were as large as in the sample, possibly 100s. per hundredweight might be obtained. The brokers stated that a small lot of fine Maracaibo cacao had just been sold at 110s. per hundredweight.

No. 2.— The brokers describe this as small, clean cacao worth from 60s. to 63s. per hundredweight in London at the present time.

It is evident therefore that the cacao prepared at *River* Estate, Trinidad, is of very good quality, and the "selected" sample compares very favourably with the highest qualities in the market.

Cotton.

The sample of cotton submitted was grown and ginned at the Experiment Station, St. Clair. It is known locally as "Creole" or native cotton, and is believed to be a short-stapled or "Upland" variety which has survived since the old cotton-planting days. This variety is stated to suit the Trinidad climate better than "Sea Island" cotton, and would therefore be more suitable for cultivation if the product realises a fair price.

The cotton was a pale cream colour, well cleaned, rather rough to the touch and fairly strong. The length of the staple was 1·2—1·4 inches, which is a little above the average (1·1 inch) for American "Upland" cottons.

The sample was submitted to a leading firm of cotton brokers, who report that it is a well-prepared cotton, and would be valuable on account of the roughness of the staple, in which particular it resembles semi-rough Peruvian cotton. They value it at 8½d. to 9d. per pound at the present time, when "middling" American is quoted at 7¾d. per pound.

Honey.

The honey forwarded for examination and valuation was produced by Italian bees at the Experiment Station, during the season

when the logwood trees were in flower. This honey is stated to be very highly esteemed in Trinidad, and it was desired to ascertain whether this opinion would be confirmed in this country.

The sample was a viscous liquid of sherry-brown colour and was almost perfectly clear. It possessed an excellent flavour and aroma.

On chemical examination in the Scientific and Technical Department of the Imperial Institute it furnished the following results :–

Moisture (at 110° C) ...	...	16·5 per cent.
Reducing sugars (as glucose)	...	80·7 ,,
Non-reducing sugars (as sucrose)	...	2·4 ,,
Mineral matter (ash) ...	...	0·24 ,,
Insoluble matter ...	...	trace
Specific gravity at 15·5° C	...	1·429
Rotation of 10 per cent. solution in 20 cm. tube at 20° C.		2·5°

The composition of honey is liable to considerable variation, but the above figures correspond generally with those furnished by the majority of samples of genuine honey, in which the moisture generally ranges from 17 to 20 per cent., the total glucose from 70 to 80 per cent., the ash from 0·10 to 0·25 per cent. and specific gravity from 1·415 to 1·429.

The brokers to whom the sample was submitted report that it is of fair colour, clear, and would be worth about 20s. per hundredweight in the London market, at which price they anticipate there would be a fair demand. For comparison with this valuation the current London prices for other varieties of honey may be quoted :—

Chili ...	..	18s. to 30s. per hundredweight.
California ...	...	20s. to 40s. ,,
Jamaica ...	...	16s. to 27s. ,,

WYNDHAM R. DUNSTAN.

21st May, 1904.

625.–REPORT ON TOBACCO.

THIS sample of Tobacco was grown on a small plot at the Experiment Station, St. Clair. The analysis shows that the chemical condition of the tobacco is "*satisfactory*," but that owing to 1. "Coarse texture" 2. "unsatisfactory colour," 3. "poor burning qualities," and 4. "unusual flavour." Measures will have to be devised to secure a better fermentation. It is known that burning qualities, and flavour are secured by fermentation and the other conditions being satisfactory, experiments will now be devoted to this point, which is genuine work for a station, specially supported for such purposes.

It is fairly clear, however, that quantities such as have been hitherto cultivated are too small to secure the needed temperature in the sweating bins, and that a similar quantity as is used on Cuban Estates will have to be grown before it will be possible to secure con-

ditions for successful fermentation. It was fully understood before sending it for examination that the character of the leaf was unsatisfactory, and the London examination, makes it fairly evident where the fault lies.

IMPERIAL INSTITUTE OF THE UNITED KINGDOM, THE COLONIES AND INDIA.

No. 79/13. Imperial Institute Road, London, S.W.,
21st April, 1904.

Sir,

I have the honour to enclose a report on some samples of tobacco, from Trinidad, forwarded with Sir Alfred Moloney's letter of the 20th November, 1903, for examination in the Scientific and Technical Department of the Imperial Institute.

I have the honour to be, Sir,
Your obedient Servant,

Wyndham R. Dunstan.

The Officer Administering the
Government, Trinidad.

IMPERIAL INSTITUTE, (south kensington, london, s.w.)

Report on Samples of Tobacco from Trinidad.

By Professor Wyndham R. Dunstan, M.A., F.R.S., Director.

These samples of tobacco which were grown and cured at the Trinidad Experiment Station under the direction of Mr. J. H. Hart were received at the Imperial Institute in December, 1903, together with a letter from Sir C. A. Moloney, Governor of Trinidad, asking that their commercial values might be ascertained.

Description of Samples.

No. 1.—This specimen, which was stated to be of the "Siparia" variety, weighed about 8 ounces and consisted of eight small bundles each containing about nine leaves. The leaves measured from 10–14 inches in length and 4—5 inches in width and were dark brown and fairly uniform in colour; a few, however, showed yellowish-white spots.

No. 2.—This sample described as "Virginia" weighed about 8 ounces and consisted of six bundles each containing eight or nine leaves. The leaves were somewhat larger than those of specimen No. 1 and were lighter and greenish brown in colour.

No. 3.—This sample, which was described as "Sumatra" weighed about 7 ounces and consisted of 10 bundles. It resembled No. 2 but the leaves were of finer texture, smaller in size and were dull brown in colour with a few green coloured patches.

No. 4.—This sample weighed 7 ounces and was described as of the "Hester" variety. It somewhat closely resembled the "Siparia" tobacco but was of uneven colour being much marked by green patches and yellowish-white spots.

Chemical Examination.

The samples of tobacco were analysed in the Scientific and Technical Department of the Imperial Institute and gave the following results :—

	Siparia. Per cent.*	Virginia. Per cent.*	Sumatra. Per cent.*	Hester. Per cent.*
Moisture	13·1	12·3	13·1	11·7
Ash (total)	16·2	15·0	16·1	17·0
Ash insoluble in hydrochloric acid	0·8	1·1	0·7	0·8
Sugar and Starch ...	Nil.	Nil.	Nil.	Nil
Nicotine	2·53	2·30	2·55	2·57
Acidity†	1·6 grams	1 6 grams	1·4 grams	1·5 grams

These results indicate that so far as chemical composition is concerned the tobaccos are satisfactory. The percentage of nicotine is similar to that found in many commercial tobaccos but the acidity is rather higher than usual.

Technical Examination and Commercial Valuation.

Samples of these tobaccos were submitted for commercial valuation to brokers and to tobacco manufacturers who were informed of the analytical results recorded above. They reported that none of the samples would be suitable for the manufacture of pipe or cigarette tobaccos and that although they were of the cigar type, yet owing to their coarse texture, unsatisfactory colour, poor burning qualities and unusual flavour, none of them would be saleable in this country for either filling or wrapping cigars.

In conclusion it may be pointed out that the demand for tobacco in this country is confined to certain well defined commercial varieties and that only tobaccos capable of replacing these or of being used in conjunction with them will be favourably considered by manufacturers.

Wyndham R. Dunstan.

20th April, 1904.

626—STUDY OF PARASITIC FUNGI.

Massachusetts Horticultural Society.

Address by Dr. G. P. Clinton of New Haven, Ct., on "The Study of Parasitic Fungi in the United States."

Dr. G. P. Clinton of the Connecticut Agricultural Experiment Station at New Haven was the lecturer Saturday, February 27, 1904, at the regular meeting of the society in Horticultural Hall. His sub-

* The results are calculated on the material dried at 100° C.

† Expressed as the weight of Sodium hydroxide required to neutralise 100 grams of the tobacco.

ject was "The Study of Parasitic Fungi in the United States," and in considering this Dr. Clinton first recalled the initial lecture on "Plant Diseases and Their Remedies," given before the society twelve years ago by the late Dr. James Ellis Humphrey of the Massachusetts Agricultural Experiment Station. The influence of that address of so long ago and annual consideration of the matter before the society by other speakers was briefly reviewed. Dr. Clinton then treated his subject matter from an historical viewpoint. Dealing especially with its early history in this country and the conditions found to-day. He said in part:

"The study of fungi in this country began less than one hundred years ago. Of course, this is not strange since at that time the country was comparatively undeveloped and the Government in its infancy. Turning to Europe, however, we find about the same condition of affairs. Previous to the nineteenth century, knowledge of fungi was confined almost entirely to the conspicuous forms, such as the toadstools. With the perfection of the microscope during the first quarter of the century, there was thrown open for minute examination those numerous parasitic and saprophytic forms that previously had been seen only in their gross aspect or had not been seen at all. While the microscopic study was taken up in this country scarcely later than in Europe, yet, because of our infancy, these preliminary investigations were very limited, practically the work of a single investigator. In considering the history of the subject in the United States, it seems to me that there have been three periods in its development. These, while not sharply marked off from each other, possess enough peculiarity to distinguish them in a general way. They may be briefly characterized as the period of collection, of instruction and of investigation.

"The first period was characterized by the collector who merely listed the specimen he found or gave vague descriptions to those that proved to be new. In point of time this extended from 1812 to 1870, or from the return of Schweinitz to this country, to the establishment at Harvard University of a department of cryptogamic botany. Louis von Schweinitz was a native Bavarian minister, who after receiving his higher education in Germany returned to this country in the interests of his particular sect. While I have little doubt that he was a useful servant in his accepted calling, I have no doubt whatever that he was an unusually good and active botanist. In 1834 he published his most important treatise on 'North American Fungi' which lists about three thousand species he had observed in the Carolinas and Pennsylvania.

"The immediate successor to Schweinitz in time and importance was a Massachusetts man, also a minister, Moses Ashley Curtis, who was born at Stockbridge and educated at Williams. In 1830 he first went South, as tutor, to Wilmington, N. C. Like Schweinitz, he was a great lover of nature as well as of nature's God, and so he soon began his study of the very interesting flora of this State and this was extended as his later ministerial labours took him to different places in it, and in South Carolina. Curtis was what your enthusiastic friends of the Boston Mycological Society might term 'somewhat of a mycophagist.' At least he gave us a long list of the edible mushrooms of that region and during the Civil War earnestly advocated their use by

his friends as a substitute for meat. Curtis also published a number of articles on fungi in American periodicals but he did not confine his attention to fungi, for one of his most important works included the phænogamic flora of his region. It might be of interest to note here that his valuable collection of fungi is now the property of the Cryptogramic Herbarium of Harvard.

"Later workers in this early period were Frost of Vermont, interested chiefly in the fleshy fungi, Lea of Ohio, and Ravenel of South Carolina. The latter's work is of special interest because he was the first to publish exsiccati of American fungi, issuing one set on the fungi of Carolina and a larger one on the fungi of North America.

"From these preliminary statements you will readily observe that these early investigators were of a different type from the plant pathologists of to-day. In the first place they gained their living through other vocations. In the second, as botanists, they were usually almost equally interested in the flowering plants; in other words, they were more of the type of naturalists than of specialists. Finally, what they knew of fungi they had gained largely at first hand, through contact with nature, and not at any institution of learning. Their work was a work of love and of pleasure, unmixed with duty and necessity. Naturally the large and showy forms, such as the fleshy fungi, received most attention, while the economic species attracted less. At that time, however, there was not great need for the study of the parasites of the garden, field, or orchard. To them we are indebted for specimens, for lists showing distribution and for meagre descriptions of new forms, but not for detailed studies in any direction, for they were pioneers.

"Coming to the second period, we find the type that characterizes it is that of the teacher. The professor and the pupil now come into prominence. Previous to 1870 the botany taught in our institutions of learning was the botany of flowering plants. Asa Gray, recognizing the importance of the subject made provision at this time for instruction in the lower cryptogams at Harvard.

"Harvard, however, was not alone in its provision for instruction in the cryptogams. About this time our State universities were coming into existence and their influence, as well, was felt in the shaping of new courses of study and the equipping of laboratories. Among the earliest to take up this work was the University of Illinois under the direction of Professor Burrill, still its head professor of botany. This educational movement has been one of slow but ever of sure and upward growth. To-day we find not one or two but practically all of our colleges giving at least some instruction on fungi, and in many institutions there are special courses in plant pathology. No longer is it necessary for the professor, or the student to go abroad for study, though this is still done to some extent.

"Our botanists no sooner became instructors than they started in to be investigators as well. These investigations for the first time took on an economic character. Professor Farlow had scarcely become established at Bussey before he issued a paper on the potato rot. That was about thirty years ago and strange as it may seem botanists are still working on the same subject. This paper was followed by others by the same author on mildew of grape, black knot, etc. Burrill of

Illinois began his studies on the fungous troubles of the Mississippi Valley and threw new light on the nature of blight in pear and apple. His discovery and proof of this as a bacterial trouble, placed these organisms, for the first time, as agents of disease in plants.

"It was in our third period of development that the investigating spirit came especially to the front. This last period extends from the founding of our experiment stations in 1887 to the present day. The experiment stations in most cases provide for a botanist on their staff, and usually his work as an investigator led him to deal more largely with fungi than with flowering plants. The experiment stations, too, provide facilities for research that were not enjoyed before. The work of the stations has served to strengthen and multiply the research work of our colleges and universities. At the time these stations were established the Government also began to extend its botanical work, especially in the line of vegetable pathology.

"I think we can safely state that the most characteristic thing of to-day is the tendency to specialize. We can still occasionally find the old type of naturalist as an investigator, tucked away in some academy of science or local college, but he is a rare individual. The man who hopes to do something of permanent value must select a limited field in which to work, and then bend his energies to study it minutely. He may be a general botanist or even naturalist, but he does not want to investigate in general botany or natural history. To succeed he ought to be a broad man working narrowly and deeply.

"I have no doubt the line of study most interesting to you as horticulturists is that of the plant pathologist, especially of the one studying preventive treatments. I have not emphasized this phase of the subject before, partially because it has been the side repeatedly presented to you and partially because the more I learn the more I realize that the terms parasite and saprophyte contrast more strongly in print than do the real things in nature, and so I am led to believe that any botanist gives aid to the science, even in its economic bearings, not so much from the point of view from which he works but by the thoroughness with which he works.

"There have been four general lines followed in the treatment or prevention of fungous diseases. These are spraying, seed treatment, soil treatment and plant breeding. A fifth might possibly be added which would include such general precautions as the selection of good seed or stock, proper pruning or picking to rid the plant of diseased members, rotation of crops to avoid accumulation of disease, and destruction of refuse to limit the breeding of saprophytic stages or wintering of spore forms. On the whole spraying has proved to be the most general and efficient treatment. Spraying experiments have been tried for almost all of the important troubles and remedies found for not a few. Bordeaux mixture has proved its supremacy as a fungicide; the value of spraying resides in its being preventive rather than curative; success of prevention lies in starting before the appearance of disease, by repetition as needed during period of infection and in the thoroughness of the work; a final factor determining greater or less success, and one that cannot be controlled, is season. Spraying, apparently, has come to stay since it has become a common practice in the larger orchards, vineyards and even in potato fields.

"The second method of prevention I mentioned was seed treatment. We got our hint of spraying from France; That of seed treatment came from Denmark. Seed treatment proves of value only in those cases, chiefly with the smuts, in which the germs that secure infection are carried on the seed. To a lesser extent, perhaps many troubles are started partially by spores adhering to the seed. Seed treatment, also, usually hastens germination. Perhaps the day will come when we will generally select and treat our seed, fumigate our stock and destroy our rubbish, but it is certainly not here now.

"In the treatment of soil for prevention of disease perhaps if the work could be made practical and efficient it would probably lessen many of our serious fungous troubles. But the difficulty lies in making it either efficient or practical. The fourth method employed to fight the ubiquitous fungus is plant selection or breeding. Nature apparently has often found this a successful way of warding off attacks; at least we find that there is a great difference in the susceptibility to attack in different varieties. Any greenhouse man knows that all varieties of carnations and chrysanthemums do not rust with the same readiness, though he no doubt often wishes this difference was more marked than it really is. There are a number of difficulties to be encountered in problems of this kind. In the first place it is evidently applicable only for troubles that are persistently injurious. Then it also means work that in most cases must run over a series of years before reliable results can be obtained. Where crossing is employed to breed up new varieties there is the danger of losing desirable qualities or of introducing those that are undesirable. Finally failure is as likely to be the reward for one's effort as success.

"During the past four or five years mycologists have had under consideration a great variety of diseases of plants, and considerable progress has been made in clearing up life histories." Prominent among these problems is that relating to Slime Moulds, also Bacteria: "Thread" fungi, or Phycomycetes; Smuts, or Ustilagineæ; Rusts, or Uredineæ; Sac fungi, or Ascomycetes; Fungi imperfecti and Fleshy fungi, or Hymenomycetes, each of which subject Dr. Clinton considered briefly yet helpfully, giving many excellent hints regarding their character and treatment. He touched upon the work of the great students of these matters and their discoveries and theories.

In closing Dr. Clinton said:

"I have thus briefly outlined the work that has been done and is being done by mycologists in this country. As to the outlook for the future, I care not to predict. It seems, however, that we have no need to complain of lack of teachers or investigators. Facilities for investigation and especially for the publication of results are fairly adequate. We are turning out enough literature to satisfy even the most rabid. Apparently what we need most of all is more method in our work and higher standards in its execution."

The preceding article although written for American Horticulturists is full of interest for West Indians also, especially so as the fungi are more numerous and destructive in the Tropics than in temperate climates. Few people suspect that the destruction of Forest trees is oftener due to microscopic fungi than to any other cause. That the destruction of their house timbers, so long attributed to the wood-

ant—duck-ant or termite, is also primarily due to the attack of microscopic fungi which reduce the wood first of all to a condition which renders it suitable for the ant communities. It is time, therefore, that such teaching should have the special attention of Horticulturists and Agriculturists, as it has of late years been shown, that the most deadly enemies to our major products are to be found in the ranks of the forms of vegetation known under the general name of microscopic or Parasitic fungi.

627.—THE BASIS OF HOPE IN RUBBER PLANTING.

A QUESTION asked by many persons, when the subject of rubber planting is first brought to their attention, is whether any rubber plantations have yet been developed profitably. If told that no large rubber plantations on a commercial basis have yet been in existence long enough for the trees to have become mature, this statement seems to afford to some minds an ample excuse for distrust of the whole business. If no large plantation of rubber is yet old enough to yield liberally, how does anyone know that rubber can be produced under cultivation? The question deserves consideration, and it may be worth while to point out some of the reasons which have encouraged the investment of a large amount of capital in rubber planting.

If an illustration from an outside field may be permitted, we may mention that the offices of this Journal overlook the first of the great suspension bridges erected over the East river, in New York city, long known as the "Brooklyn Bridge." When this structure was first planned, back in 1867, no suspension bridge on such a stupendous scale had ever been built. None had even been planned. It was a great risk to put up in the air a span a third of a mile in length, weighing of itself thousands of tons, and intended to support a vast and incessant traffic Many people said it couldn't be done; they kept on saying it for sixteen years. So long as the bridge was building people were writing to the newspapers that such a bridge was impossible—because nothing of the kind had been done before. At last the bridge was completed, and for twenty years it has been a constant thoroughfare for more traffic than anybody ever dreamed would exist.

But the bridge was no mere experiment. The engineers who drew the plans and calculated the quantity of materials needed to give certain results simply applied known and tested principles of construction; the new bridge was merely bigger than any that had been built before. Now a second bridge, of still longer span, stretches over the East river, and it causes no wonder.

The application of this to the rubber planting proposition may not be so remote as might at first seem. It has been abundantly proved that a rubber tree seed planted carefully by hand will grow into a tree not differing from the product of a seed dropped by nature and finding a chance place to germinate. It has been proved that the rubber product of such planted trees differs in no way from that of a rubber tree in the forest. Small plantations of rubber, of various species, in different countries, have produced rubber under conditions which point to a lower cost of production than in the richest forest

areas exploited for this material along the Amazon, or anywhere else. Furthermore, the product of such cultivated trees, being cleaner and otherwise better prepared, has brought better prices in the markets.

It should not seem an unreasonable proposition, therefore, that if a few planted rubber trees grow well, a large number should grow equally well under like circumstances, or that if hundreds of trees on a given estate yield at a certain rate, thousands of trees should yield proportionately more. The laboratory test of the tensile strength of steel suffices for estimating the dimensions necessary for a gigantic bridge, and what has been done with a handful of rubber trees is possible to be multiplied with a great number, particularly since the experiments with small numbers of trees have been in progress for more than thirty years, in many localities, and all point to practically the same conclusions.

It might be added that when a new invention in rubber is made, the owner of it does not wait to make and sell millions of specimens before determining whether the article has merit. Generally, if one or two give good results, it is assumed that all of an unlimited number would do equally as well, and the cost of manufacture is figured out in advance, instead of waiting until the goods are produced in great quantities, and the bills for material and labour are in hand. The leading planters of rubber have proceeded upon precisely similar lines in setting out millions of trees, in the hope of duplicating with so many the results obtained from a small number here and there in the past.—*Editorial India Rubber World*, May 1, 1904.

628.—THE FOWL TICK AND HUNTER ANT.

Sometime ago, Article 331, Bulletin for April, 1900, I described the ravages of the Fowl tick in our poultry yard.—(*Argas, sp.*)

For the past two years no trouble of any importance has been experienced from this plague. This is partly on due to the preventive measures adopted, and partly to the assistance of our friend the "Hunter Ant."

This is a large black ant which travels in large communities. The appearance of a company when on a foraging expedition, as it winds in serpentine form along the ground in large numbers, closely resembles the movements of a snake. While travelling in this manner, they destroy very many forms of animal and insect life, such as lizards, cockroaches, spiders, and even attack large animals, such as horses and cows, &c., when confined in stables or other places, and they enter houses and destroy every trace of insect life. In the fowl house they destroy the fowl tick, and in dwelling houses where they exist, individuals of the genus "Cimex" or in the vernacular "B. Flats" are soon exterminated. They are thus very useful, and especially so for the service they perform in the poultry houses.

When resting, these ants assemble and hang in large clusters like a swarm of bees, but seldom remain long in one place. The army when on the prowl sometimes covers a length of one or two hundred feet, while the breadth of the column ranges from one to three or four inches.

When these insects visit house, stable or elsewhere, it has to be vacated at once, for a time, (often 4 or 5 hours) as anything living is sure to suffer from their attack. Horses especially have a great dread of them, and plunge and kick in the effort to get free, which is often the first notice to man, of the approach of these formidable creatures. The workers of the column are some $\frac{1}{2}$ an inch in length. The male and female forms have not been seen by us, and the place of the insect in classification is not as yet to our hand.

We should be glad if any reader can supply us with further information.

629.—SOMETHING ABOUT POULTRY.

In publishing this article on Poultry, we are led to do so in answer to frequent enquiries. The subject matter describes in full the practice which has been successfully followed under our own eyes for many years past and is therefore placed before our readers with confidence, but we are largely indebted to a *Bulletin* published by the Queensland Government in 1896 for the substance of the article, the matter of which has however been edited to meet West Indian conditions:—

"Though there is not a big fortune to be made by poultry, there is more than a living for the man or woman who goes into the work systematically and with a determination to succeed. It is a common cry that fowls don't pay; but go to the housewife who keeps her score of hens or so, and ask how many dozen of eggs she sells per week to her neighbours? Ask the farmer what he makes by his eggs? Both will tell you that their fowls pay them handsomely.

"There are very few industries in the world that require so little capital to start them as poultry-farming. Many instances are known where £5 has been expended far more successfully, and has produced much greater results than £50.

"A man who is handy with tools can put up his yards and fowl-houses at very small expense; and if he is willing to wait, or can afford to do so, till he has raised his stock from the eggs, a £5-note will buy him good stock and give him an excellent start.

"What is wanted among poultry-keepers is a better class of stock. Mongrel hens eat more and lay fewer eggs than the better bred strains. At the same time, a yard can be improved by the introduction of good male birds; and it is better that this should be done instead of doing away with the flock to make a fresh start. It is truly wonderful how soon a miserable-looking, in-bred, undersized collection of fowls can be improved by judicious selection for breeding *from*, and the mating *with*, well-bred roosters.

"For instance, suppose some reader has a pen of mixed and mongrel birds; let him look round for a vigorous young half-bred rooster, and, picking out six or eight of his best hens, pen them up together in a wire netted yard.

"If he can manage to buy a few eggs from someone who has better fowls than his own, he should do so, or he may be able to exchange a couple of birds fit for killing for a few good eggs; and these, when hatched, will give him a little fresh blood. When these

chicks are old enough to lay, let him exchange, borrow, or buy a pure-bred rooster of some sort; and the stock he will get from him, with the birds he has reared himself, will lay the foundation for a very good flock. Then, by degrees, he can either sell or exchange the remainder of his mongrels till his yard begins to present quite a well-bred appearance. In a short time we have seen a pen of weedy mongrels transformed into one of handsome half-bred.

WHERE TO BUILD THE HOUSE.

"Many poultry-keepers have little choice of location, owing possibly to the bad lay of the ground on which they are compelled to put up their fowl houses. But when it is possible to choose, select dry land, sloping towards the east or south and with natural drainage. If forced to build on level land, it will pay in the long run to have it well drained. There is no greater breeder of disease than a damp house. Sandy soil, or soil underlaid with gravel, is the best on which to build. It is folly to say that the poorest land will do for chickens. They, as much as other live stock, require good land to range over, considering that the product of the soil in the shape of vegetation and its natural accompaniment of insect life have so much to do in the development of healthy, strong, and profitable fowls.

LEARN TO KNOW THE BREEDS.

"Every breeder should study the breed he keeps; there is no reason why a breeder should not be as good a judge as the majority of authorised judges, and he should learn to be so for his own satisfaction and protection; he only needs to take the standard as his guide, and then pick up experience by observation at the shows, markets, and neighbouring yards. There is nothing exclusive about the matter of judging, though some men, of more assurance than knowledge, succeed in impressing the public with the notion that they are endowed above all others with a faculty of judging fowls. It is nonsense; any thonghtful man who reads up the subject and takes the standard as his guide will very soon become a good judge of the breeds he is interested in. In fact he may set the "Fancy."

KEEP GOOD BIRDS.

If going in for a pure breed, it is no economy to buy second class stock, whether it be as birds or as eggs—get the very best to be bought, and then you have the opportunity of making your money twice over in a year or two. In many districts, the breeder who starts with first-class stock and establishes a successful strain has the chance of making money, particularly if he succeeds in identifying his name with the breed he takes up. To get the best return from the poultry yard, as much as possible of the food should be grown at home. Four acres properly and systematically cultivated will supply a very large poultry yard.

"Everything depends on getting a good strain of fowls; and for marketing eggs, it should be one of the non-setting strains. Judging from experiments made lately in the matter of feeding for eggs, I believe the White Leghorns can be made to give a far better record as egg-producers than poultry farmers have any idea of at present, and I don't doubt but other non-setting varieties are equally prolific.

"For the pure-bred stock it is better to build ten or a dozen comfortable pens close to the dwelling house, and to keep Game, Leghorns, Orpingtons and Minorcas. Those four varieties would be sufficient to start with, and they should be of the very best and purest to be got. From these pens breed all the laying hens, crossing them when good or exceptional qualities are observed in individual members, for it is a fair conclusion that certain points and qualities are not so much confined to any special breed as to particular individuals in *every* breed. Feather, of course, belongs to breed always, but laying qualities, vitality, &c., may be found in any and in every breed in certain birds, therefore it is those one wants to breed from, to develop their powers. It is better to keep a few pens with exceptional points, and get a name in connection with them, than to have a large number of second-class birds.

"The pure-bred birds should pay for themselves by the sale of their eggs for breeding purposes and the sale of stock birds. To secure such sales, and to make their reputation and identify your name with them, advantage must be taken of every show and exhibition of poultry, public and private. If your birds do not take prizes say nothing about it, but when they *do* take prizes be sure to advertise and talk about the fact. Sell the roosters every year, and always endeavour to get a better bird each time you buy; and until you thoroughly understand all the best points do not attempt to buy yourself, but get someone who does know to choose a bird for you. The fashion in poultry is constantly changing, and thus fanciers send their old birds to the saleroom or market, and replace them with those of newer points and style.

"Never sell an egg, or a single bird from a pen till you have secured one season's birds yourself; if you do, you may have to compete with birds from your own stock. Get one season ahead, and you are fairly safe—that is, if you go on the plan of improving each year.

"The pullets only being used in the laying-yard, there will, naturally, be a large number of pure-bred roosters. Those that cannot be sold for other breeding-pens, or to improve other flocks, should be killed and sold in the form of dead poultry. You should always have a few good customers to supply regularly with dressed poultry, at a fixed price all the year round—give *them* your surplus pure-bred birds. With eggs it is the same: you can only set a certain number, and you can only sell a certain number at fancy prices; then you must destroy the germ of life in the rest and put them in with those for market.

"To keep such a poultry yard going, incubators would be necessary, and they would have to be at work all the year round, to keep up the supply. The foster-mothers would have to be kept close to the house too, for the convenience of feeding and attending to the chickens. These should always have a certain proportion of chickens running with hens, allowing them free range over the ground.

POULTRY-HOUSES AND PENS FOR BREEDING BIRDS.

"As regards the best kind of house there is great diversity of opinion; Some maintaining that close wooden houses are necessary, while others build principally of wire. It all depends on the

varieties kept, and the climate they are in. In some places fowls do well without houses, merely roosting in the trees; and roost anywhere and everywhere, which proves how well poultry will do under proper conditions; for if they can pay without attention or care bestowed upon them, how much better would they pay with it. Game fowls certainly do not require a house and prefer to roost in the trees. The only disadvantage of the practice is that they become very wild and difficult to catch. A large Poinciana tree, a fig-tree, or banyan-tree makes a capital roosting-place, and gives them good shelter. Still, it is best to have a house for them for many reasons, even if it be but *a roof with a back wall* to support and cover the wide, sloping, ladder-like perches. This is the roughest and readiest fowl-house for the small breeder to put up. It must be built with the back to the quarter from whence the worst winds come, as strong winds affect fowls even more than heavy rain does.

"The lighter the fowl houses are the better, and the less harbour there is for vermin. For roosts there is nothing better than the wide ladder for the light active varieties, and for the heavier – such as Langshans, Brahmas, Cochins, &c., &c.—single perches no higher than two or three feet from the ground. All perches or roosts should be round, and of a size and strength to ensure confidence. One of the most common mistakes made by poultry people is giving the fowls square roosts. A little observation will show that all the branches, twigs, &c., of the trees are round. Nature has fashioned the birds' feet to grasp them; fashioned them indeed purposely for holding on to a rounded surface, and, more than that, so formed them that while sitting on the rounded perch they (the feet) are, as it were, locked on to it, and cannot fall off unless the bird stands up first. Directly the leg bends (when the bird perches in fact) the toes become clasped; when the bird stands up they relax. Consequently square perches must either be constant pain and misery all night, or else a source of anxiety and worry because of their insecurity. As the hen can only rest *on* the square perch and in sleep, sudden shock, or any disturbance among the others would fall off. The effort to hold on and to grasp the sharp edges of the square roost must cause great pain. It is clear this item of the perches is a very small matter, but it means a good deal to the hen. Study the fowls as a whole class, note their habits and customs, then take each breed and closely observe its ways, and finally learn to know and understand the nature and special characteristics of individual members of the flock till each fowl is a separate friend. And you must learn to know them thoroughly if you would make a success of farming them. The best roost of all is a strong straight rod, slightly dressed or flattened on the underside, and it should be strong and perfectly firm. Chickens that have always roosted on rounded perches very seldom have crooked breast-bones.

"Where a large number of fowls are kept, it is advisable to have more than one house, as overcrowding is sure to bring disease. Let the houses be as airy as possible without being cold, draughty, or damp. It is a moot question among breeders whether the floor should be of boards or earth. Earth is best provided the locality is not damp.

"Every morning dry earth, mixed with sand or a little dry lime should be scattered under the roosts to cover the droppings, which

must be removed to the compost-heap twice a week without fail, or every day would be better.

"If the houses or pens smell unpleasantly in damp or hot weather, dissolve two or three tablespoonfuls of copperas in a garden watering-can and sprinkle the floors, the perches, and under them.

"All the houses and roosts require to be whitewashed every now and then with a good lime wash; nests and all should get a coating. It may not be sufficient in itself to keep vermin away, but it will help to do so.

BREEDING-PENS.

"It is as well to make up these a week or two before the birds are ready to lay, as a safeguard against impurity of stock. Hens, and pullets too, are apt to receive the attentions of the roosters for some time before they begin to lay, so that to be quite sure of the parentage of the chickens on the sire's side the birds must be mated early.

"A mongrel cockerel running with the hens, say a fortnight or even three weeks before penning, may possibly leave his impression upon the first lot of chicks hatched; therefore he should be got rid of before he can do harm.

"The very best birds should be selected for breeding purposes. Careful and persistent attention and mating with good birds every season will soon improve the very worst flock. It will pay every breeder to breed only from his best birds; and if his flock is not satisfactory in the matter of productiveness, he should at once get some new blood into it. If he wants more eggs, a Leghorn, Houdan, or Andalusian cock will be best; and if he wants good strong stock, he must not allow too many hens to the one cock. Four to six will be a fair thing. When buying a bird to breed from, it is as well to isolate or quarantine him for a few days, in case of disease.

"To keep up the vigour and fecundity of the flock, infuse new blood into it every year or two. Even when the fowls kept are only *the commonest barndoor breed, new roosters every year or two are a necessity, or the egg supply will fall off and the eggs become small.* In-breeding is a mistake, though every poultry-keeper indulges in it to a limited extent and fanciers, who breed for feather, in-breed to a large extent to produce exhibition birds, but very often these same birds are wanting in vigour and stamina. This is mentioned because some reader may be inclined to instance the doings of fanciers as a contradiction to my statement, that close breeding is unwise. The practical poultry-keeper will do well to get new blood every twelve months. Get as good blood as possible, but even a mongrel bird will help the well-bred birds better than none at all. In fact, very often a mongrel will bring points of hardiness and endurance into the flock that cannot be obtained from those that have been carefully reared for generations. The action and general appearance of the birds will tell whether new blood is needed or not. If the roosters are attentive to their hens, courting them in every way, catering and scratching for them, it is safe to say they have sufficient vigour and vitality. But if the roosters are dull, lazy, and inattentive, and the hens quiet and hanging about the feed-troughs instead of hunting, it is about time to rouse them up by the introduction of new roosters.

"There are many adverse opinions on the subject of in-breeding, most of them against the theory that fresh blood is needed every twelve months. In-breeding cannot be indulged in without one of three things happening—either loss of health generally; loss of fertility, size, and number of eggs; or loss of size in the birds, and abnormal growth of feather. When choosing the hens for breeding from, three characteristics should be considered—viz., good health, good laying powers, and good size. Health is everything if you wish to breed birds for market, as unhealthy or weakly chickens will not pay for the food, time, and attention necessary to fit them for the market. A hen that lays misshappen eggs should be excluded from the breeding-pen, no matter how prolific she may be, also if the egg has a bad shell. These may seem very trivial matters, but they are of moment to the man who would have good fowls. The farmer will not breed from the cow with a bad skin or the horse that is ill-formed; and on the same principle the poultry-keeper should discard the hens that lay eggs that are not perfect. Crooked chickens, small and badly feathered, come, as a rule, from imperfect eggs. Another source of unhealthy chickens is dirty eggs. It is no advantage to set the largest eggs; they will not hatch the largest chickens. The ordinary medium-sized egg is the best for hatching, provided the shell is of good texture, smooth, and glossy—not rough and easily broken. The *size of the hen that lays the egg* is of more importance than the size of the egg itself.

"The rooster to be penned up should be older than his hens, if possible. The favourite ages are: For hens twelve to fifteen months, the rooster about two years, and allow from three to seven hens to each rooster, according to the size of the pens. In a pen made round a tree, three hens and a rooster will be quite enough.

"It is not wise to breed from pullets. As a rule the chickens are weakly, and many of them die off, simply from lack of constitution. Where it is actually necessary to breed from a pullet, let her be mated with a rooster three years of age; then you may be successful.

CARE OF EGGS.

"Eggs should be gathered regularly every day. It is a great mistake to leave them to accumulate in the nests. A fertile egg begins to change within six hours when sat upon; eggs left in the nests over night, under broody hens, will not be fresh eggs in the morning. The germs will have started to grow. During the wet season the germs start in eggs that have been laid in nests where several hens have been laying during the day.

"Every egg intended for hatching should have the date marked on it when brought from the nest, and then it should be placed in a cup or frame made for the purpose, the large end down. The air bladder is at the large end of the egg, and by turning the egg on to it you prevent it from shrinking and drying. The egg can stand (large end down) in its cup for three weeks and then may be hatched, though, of course, the fresher the eggs the better for hatching purposes. The freshest egg always hatches first, sometimes as early as the nineteenth day. It stands to reason that the fresher the germ when it is started, the stronger will be the life that is produced from it. The weakly chickens in the clutch are the result of stale eggs as a rule, and

especially is this with ducklings. When eggs for hatching come from a distance or have experienced a rough journey, it is advisable to let them stand on the large end for twelve hours before putting them under the hen.

HATCHING AND THE MANAGEMENT OF SETTING HENS.

"For this purpose pick out eggs of uniform size, none abnormally large or small; and never, if possible, set an egg with a very thin or defective shell.

"Having picked out the eggs for setting, see that they are perfectly clean. A dirty egg will not hatch a healthy chicken; If very dirty it will go bad. A greasy egg will not hatch either, or one, the pores of which have been filled up in any way whatever, which conclusively proves that the pores have a function to perform towards the growing germ within the egg. If it is at all possible, let the hen set in the nest she has been accustomed to lay in. She will set better there than elsewhere, and be no trouble at all, because she can be left to come off and on for food and water at her own pleasure. If it is not possible, through other hens using the nest, to let her retain her old nest, make her one close to it, and before entrusting her with the eggs, get her accustomed to it, by giving her a couple of china or nest eggs for two or three days. Nests for hatching may be made in the grass, an old stump, a hollow log, anywhere but in a house where for some reason or other vermin breed quicker than anywhere. Setting hens require very little food. This is accounted for, I think, by the fact that hens are usually in the very best condition when they stop laying, and in some mysterious way they live on their fat while setting and in general it is best to let them come off when they please.

"It is a mistake to give a hen too many eggs at a setting. A small hen will cover nine to eleven: a large hen from fifteen to seventeen. If the nest is a strange one to her, put the hen on at night and shut her in for the first day or two. It is useless to set pullets or hens that are broody for the first time. When she is eighteen months old is time enough to trust a hen with eggs. If forced to use a young hen, let her set only half time, and get an older hen to hatch the chickens. If an egg gets broken in the nest, and the hen does not remove it herself, do so for her, and wash all the eggs that have the least bit of egg on them. A basin of warm water and soap,—or even cold water will not hurt them,—and it is quickly done. The eggs need not be dried; the water is good for them. In a very dry season it is often a good plan to damp the eggs the last week, whenever the hen is off. Duck-eggs require it more than hens' do, unless ducks are on them, when they see to it themselves. The chickens should make their appearance on or about the twenty-first day, but much depends on the way the hen has set. Very often she does not settle properly on to the eggs the first two or three days. If the nest is strange, too many eggs, or a very young hen, then the chickens may not hatch till a few days later, and some may be much later than others. When this is the case, the first lot should be taken from the nest and kept in a basket, in flannel, till all are out. If left they may get trodden on, also, when two or three are out a good while before the others, the hen may become restless and want to leave the nest

with them. When they are all out, replace them with the hen, and let her alone for twelve hours, only sprinkling a little dry oatmeal in the nest for the hen to teach the chickens to feed, and to know her call. Never feed till the chickens are twenty-four hours old *at least.* Many chicks die through being fed too soon. Then give the hen as much as ever she can eat; first let her fill herself, and also give her water.

"The first food should be chopped egg, if eggs are plentiful; if not, a little oatmeal, just moistened with milk so it will crumble, will do just as well, and some fine bread-crumbs. Give only this for the first week, then any small grain, canary, hemp, or broken wheat—any will do, but still give oatmeal as well. It is a mistake to think that the hen mother will run her chickens too much as she knows just as much about her chicks as a human mother. Let her have her freedom, and feed her and her chickens whenever she comes up. She will not bring them up unless they are hungry.

"Soaked or boiled wheat is an excellent food for growing chickens, particularly if you can boil a piece of meat in with it, an eel, or waste fish. The great secret is to keep the chickens full, never let them be hungry for any length of time; their future value all depends on the treatment they get while chickens. A poorly-fed chicken will not make a good layer. Never give chicks sloppy food; even bread should not be soaked for them; the best way is to grate it if very dry, or put it through a mincing-machine.

"For fifty chickens the following makes an excellent feed:—Two cups bread crumbs, one cup oatmeal, two cups meal of some sort or bran, one cup wheat or cracked corn; mix all together and just moisten, so it will crumble easily, with skimmed milk. Twice a week allow one cup of dried or minced meat. The above quantity makes a good meal for fifty chickens from a month to six weeks old. Never leave food about in the tins or troughs for the chickens; they should clean up at every feed; and if they do not, reduce the quantity at once. Stale food is apt to collect germs and induce disease in the chickens that eat it. Gapes, worms, and indeed more than half the sickness, and most of the deaths among young stock can be traced to the chickens eating fermented food. The drinking water is another fruitful source of disease; it should not stand in the sun, and the tins or fountains should be thoroughly scalded every now and then. Look after the young stock, and they will repay you for your trouble.

"If breeding for the show-pen, it is not safe to kill off the under-sized and worst-looking chickens, for it frequently happens that the worst-looking and the worst-feathered chick eventually becomes the best-feathered hen.

"Be sure the chickens have fresh water morning and evening. They do not very often drink between times, but they will not thrive unless they have good drinking water from the day they are first fed. Milk is not a substitute for water, though it is very good (when sweet) for the growing stock. It can also be given when thick, provided it is not stale. You might just as well give young chickens poison as give them old cheesy milk. Directly it gets old—let it be boiled into

curds for the older fowls. Once the chickens are feathered they should be encouraged to roost, by being driven into the fowlhouse or where the roosts are. The hen will generally teach them to roost, after which they are of no further trouble.

"Directly the young cockerels are noticed chasing the hens they should be separated from the rest and put into a pen by themselves, and either fattened for market or sold to improve other yards. Those intended for the show-pen should be kept apart, fed generously, and handled as I have directed elsewhere. Pullets for the show-pen should be penned up also, and specially treated.

FEEDING THE FOWLS.

"Fowls are very early risers, and should be fed as soon as possible after they leave their roosts. Grain is best suited for this time of day. Meat is a wonderful egg-producing food, and I would advise every poultry-keeper to arrange with his butcher for the supply of a certain amount of waste meat for the laying hens each week. It has been said that much meat makes the eggs coarse and strong in flavour; this is only so when no grain food is given. For instance, hens fed on meat, pollard and bran, or only soft food will produce eggs of a strong flavour and very rich-looking yolks. But if a fair amount of grain be fed with the meat, and the fowls have access to plenty of green food, there will be no better flavoured eggs. Raw meat will impart an unpleasant taste; but all meat for the hens should be boiled to rags,—unless it be dried and ground or pounded up, when it would not be so good for laying hens. Fish, also, makes an excellent food for all kinds of poultry, particularly for growing stock; and as there are very often quantities rendered unfit for human consumption during the hot weather, those poultry-keepers who can do so, should try and make some arrangement with the fishermen to let them have all their "gone-off" fish before it gets too bad. It will not do to kill birds for table off a diet of fish; they require to be penned up and fed for about ten days on other food, and a good proportion of grain to harden their flesh.

"One thing with regard to feeding meat to the hens: It does not do for the breeding stock, as it reduces the fertility of the eggs. Too much fish has the same effect; and hens penned up for breeding should have no more than a moderate share of meat while laying. Sweet potatoes, either boiled or raw, are excellent for fowls; and, a diet of them makes a very noticeable difference in the quality of the eggs. The yolk is rather light in colour, but the "white" firm and thick without the least liquid or watery matter about it. So rich are they sometimes, that they have been known to thicken a pint of milk without any cornflour or any other thickening being necessary.

"The great secret to keep the hens laying is constant change of food, and variety in what you give. Where a large number of fowls are kept the food should be measured, so as to allow of each one getting a fair share. They will look after themselves, provided the food is distributed so that all can get to it. If bone-meal or bone-dust (it is often called) is procurable, it will pay to always have some, and allow about a cupful to the soft food for fifty hens once a day. On a large poultry farm it will pay to buy a small bone-mill and crush the

meat bones. Some of the bones should be burnt, then crushed and scattered to the fowls; by this means they will get both charcoal and good grit. Fowls are almost as fond of bones as dogs are, particularly what are called green bones; they require to be chopped up small with a chopper or big hammer, when they will eat them as eagerly as meat, and they are just as good for them as meat, as bones contain both nitrogen and phosphates, while meat contains nitrogen principally. When oats are fed to fowls they should be soaked over night or for some hours.

Never leave food to ferment in the food-troughs. If the fowls fail to clean up after each meal they are too well fed and getting too fat for their work.

"Don't feed a lot of useless scrubs that are good for nothing but the pot. Weed them out as soon as possible; it pays to cull closely.

THE FOOD VALUE OF THE EGG.

"Like milk, the egg is a complete food in itself, containing everything necessary for the development of the perfect animal. Bones, feathers, muscles, and everything that a chicken requires for its development are contained in the yolk and white of the egg. This proves that the egg is a complete food in itself. If not damaged in the cooking it is the most easily digested of all food and contains more concentrated nourishment than anything else in the world; the albumen, oil, and saline matter, as in milk, being in the exact proportions for sustaining life. Three boiled eggs, with the addition of a slice or two of toast, will make a breakfast sufficient for a working man.

"An egg weighing $1\frac{3}{4}$ oz. contains 120 gr. of carbon and $17\frac{3}{4}$ gr. of nitrogen, or 12·25 per cent. of carbon and 2 per cent. of nitrogen, according to a chemistry journal. The value of 1 lb. of eggs as for sustaining the active forces of the body is to the value of 1 lb. of lean beef as 1,584 to 9,000. As a flesh-producer, 1 lb. of egg is about equal to 1 lb. of beef.

"A hen will consume on the average 1 bushel of grain yearly, and lay 10 dozen or 15 lb. of eggs. This is equivalent to saying $3\frac{1}{4}$ lb. of grain will produce, when fed to a hen, five-sixths of a pound of eggs; but five-sixths of a pound of pork requires about 5 lb. of corn for its production. Therefore, comparing the nutriment in each and the prices of the two on an average, the pork is more costly a food than eggs, and less healthful.

VARIETIES TO KEEP.

"Every poultry-farmer should keep a few good Game roosters—Indian Game and Malay for preference—for the purpose of crossing for table birds. The Dorking is one of the most useful varieties, both as a pure-bred and used as a cross. It is a large-sized bird; and its meat is tender, savoury, and juicy, at the same time firm in texture. None of the modern breeds combine all the qualities found in the old-fashioned Dorking. The broad, deep, and projecting breast makes it very valuable as a table bird. The Houdan is the nearest approach to the Dorking in shape and in quality of meat.

"A good breast is the great thing in table birds, and unfortunately this is where so many breeds are deficient nowadays. The Langshan is an exception, and the Plymouth Rock now and then shows depth and width according to his nearness to his forebears, the Dominiques. When breeding for table, directly it is noticed that the birds are running to too much rump, as it is called, new blood should be introduced into the flock. The Brahma is very much inclined to this, for which reason it makes a bad cross. Experience and experimenting will very soon point out what combinations makes the best table birds.

AILMENTS AND DISEASES.

"Liver disease in some form or other is by far the most frequent of all diseases in this climate. The symptoms are not always alike, but as a rule there is discolouration of the comb and loss of weight; though the birds may eat well, the food does not remain in the crop, but passes through in an undigested state. The trouble may be constitutional, or brought on by damp or cold, or it may be the result of over-feeding, the birds being allowed access to soft food at all times.

"Chickens will often develop liver disease from being too freely fed on sloppy rich food. To cure it in grown fowls give one grain of calomel every second day for a week or ten days, also a pill made up of cod-liver oil, oatmeal, and a little powered charcoal every night and morning. Unless a bird is very valuable it is not worth while bothering with, once the disease has got a strong hold. It is seldom safe to breed from a bird that is inclined to liver disease, and certainly not before the season following recovery.

"*Crooked breasts* are very common in this colony. They come from constitutional weakness, in-breeding, and want of bone-making material in the food. The disease or rather ailment, for it is hardly a disease, corresponds to rickets in children. The only remedy is to build up the constitution of the flock by supplying bone-dust, and giving some preparation of iron in the food.

"*Scours*, or *dysentery*, is a common complaint among chickens. It may be the effect of bad feeding, overcrowding, too much of the same food, or a dozen other things. The droppings are very watery, and like curdled milk, or yellow, even orange-colour at times. Give 15-grain doses of Epsom salts for three days.

"To help the moult, give iron tonic and sulphur or a few handfuls of sunflower-seed every day.

"*Hard Crop or Crop-bound.*—For obstinate or very bad cases the only thing is to open the crop, clean it out thoroughly, and sew it up again. It may sound a very formidable operation, but it is not so in reality. The crop should be opened at one side, pluck away some of the feathers, and then with the scissors make the opening. Turn the contents out, using something such as a tooth-brush handle to get all the food out. Having done that, wash the crop out with a little warm water; then very carefully draw the inner skin together first, and put three or four stitches in and tie them; then take up the other skin and put the ties in between where the under ones are. Shut the bird up for a day or so, and give no food for twelve hours, then only a little and dry, as sloppy food may cause the wound to fester. Sometimes the hard mass may be softened by pouring warm water down

the bird's throat and working the crop gently in the hands; but frequently the cause is from a bone or some hard piece of food getting stuck across the opening from the crop to the food canal, for which reason it is necessary to use a tooth-brush handle or something else to get the opening free.

"*Imperfect Eggs, Whites Only, Without Shells, &c.*—This is usually caused by improper feeding, over-feeding, too great stimulation of the ovaries; and now and then it may be from a severe shock. To cure it, put the hen off laying, and build up the constitution.

"*Soft Eggs.*—This is not a disease, but merely evidence that the food is not of sufficient variety to contribute the lime for the shells of the eggs. Many poultry-keepers are under the impression that they must give oyster-shells to the fowls, or they will lay soft eggs. This is a fallacy, as thousands of hens never see oyster-shells, yet their eggs are always well covered. A moment's thought will prove to the intelligent poultry-farmer that the lime to cover the egg must be in a soluble form, or come from that which can be digested and conducted to the eggs through the blood. Nearly all kinds of food and all water, more or less, contain lime in a soluble form; and by combination with vegetable acids, and in the form of inorganic salts that are soluble, the process of covering the eggs with shells is carried out day by day without aid from oyster-shells. The oyster-shells cracked up very small are invaluable as grit. When a hen lays soft-shelled eggs the cause is due not to lack of lime so much as to her own condition of being over fat. All soft eggs may be put down to an over-fat condition.

"At the first sign of any infectious disease all the run should be thoroughly purified. If not possible to burn it, let it be well swept and lime or wood ashes scattered about liberally—the latter have a very purifying effect.

"Chickens kept in confinement must be supplied with grit of some sort every day, and charcoal or burnt bone; not only does it help them to masticate their food, but it also supplies bone-making material.

"*Warts, Chicken-pox or Yaws.*—This is a very common disease. For many years it has been known under the name of yaws on account of the hard, dry scabs that form on the head. The best treatment known is the following:—The disease is most infectious, and frequently runs through the whole of the young stock. The birds are sick and mopy for three or four days before the spots develop, as a rule. Once they come out freely the little things seem to feel better and recover their appetite. Wash the sores with warm water and carbolic soap, and when dry anoint freely with Iodoform ointment. This disease must run its course; you can only help it, or prevent it being very severe. Give a dose of salts in the soft food every few days, feed on soft nourishing food, and be sure it is sweet. Bread soaked in hot milk, oatmeal moistened with milk, scalded bran and pollard, house-scraps, and plenty of green food. Give good pure water and iron rust in it. On no account give curd, uncooked vegetables, or sour milk; anything, in fact, that will set up fermentation in the crop. The head, eyes, &c., will require washing every day. Once the birds become blind they must be handled, and their strength

kept up till they can see again. Always add a little sulphur to their food, in bad cases, where the birds are very feverish. It is very seldom they recover when the disease goes on intensifying and growing worse up to twentyone days. The great thing is to keep up the strength, as the disease is terribly debilitating.

"Yaws or chicken-pox is by far the most fatal disease among chickens. Adult fowls are seldom attacked with it, or indeed any after they have passed three months of age.

"*Gapes.*—This is another chicken disease, and comes from their eating food that is fermented and full of disease germs, or from sleeping on damp, dirty ground where other fowls have slept and roosted before. Gapes seldom or never come, except after heat and damp. The tiny eggs, which are secreted in the throat and round the entrance to the crop, will only hatch at a certain temperature and under certain conditions; and if these conditions are absent, the eggs will remain where they are month after month, or till the chicken has become strong enough to eject the worms directly they hatch, and cause discomfort.

"The worm is very small and double or forked, and they attach themselves like minute suckers to the roof of the throat, and the sides just behind the tongue. I have also found them once or twice in the nostrils. The symptoms are a frequent gaping and a cough or sneeze, and affected birds are generally to be found round the water-tins, where by constant drinking they try to allay the irritation and fever caused by the worms. It is through the drinking-water that the disease is spread, for the chickens cough and sneeze over it; and each time they do so both worms and eggs are ejected into it and greedily picked up by other chicks standing by, and thus they too get the disease. A teaspoonful of kerosene in the drinking-water of affected birds will do good and help to heal the throat after the worms have been killed. But all birds known to be or suspected of suffering from gapes should be isolated at once, and the rest of the yard treated to a good feed of chopped onion or garlic, either raw or cooked, which is the best preventive of the disease.

"To cure those that are already suffering with the disease, place them in a cask or box and cover with a bag; then put a few handfuls of powdered lime into another coarse bag; introduce it into the cask, and, while keeping the latter covered, shake it vigorously. The idea is to let the lime get into the throats and nostrils, and make them cough and sneeze. Two or three applications of this treatment will cure the most obstinate case of gapes; as a rule, one is sufficient. Another method is to dip a feather in Turpentine and quickly pass it down the windpipe of the fowl. This is also very effectual when properly carried out.

"*Hens Eating their own Eggs* is another morbid craving, and it is also caused by an uncomfortable nest, or the wish to clean up the mess when an egg has got broken in the nest. If an egg is broken during the first few days of setting, the hen will at once eat it to get rid of it, but that is not saying the hen is an egg-eater at other times. Very, very few hens eat their eggs from choice, therefore one should always inquire closely as to the comfort and surroundings of the nest before

condemning the hen. If it is conclusively proved that she is a persistent egg-eater, I fear there is no way of curing the habit, and I would advise her being killed, unless a very valuable bird, when a trick-nest might be tried (*i.e.*) a contrivance by which the egg rolls out of sight directly it is laid."

630.—THE WEATHER.

During the past "dry season" frequent heavy showers, have fallen, contrary to the average of seasons.

The rainfall at St. Clair, Experiment Station for the dry season 1904. February to May has been as follows; the difference between it and the average fall in 42 years being shown.

RAINFALL.

Dry Season 1904.		*Dry Season average—42 years.*	
February ...	... 2·56 inches.	February ...	... 1·60 inches.
March ...	... 4·24 ,,	March ...	... 1·87 ,,
April ...	... 2·50 ,,	April ...	... 2·11 ,,
May ...	... 2·76 ,,	May —	... 3·81 f,
Total ...	...12·06	Total ...	... 9·39

The dry season of 1904 is therefore 3·67 inches in excess of average. This fact is not unusual, as many previous years of the previous 42 have exceeded 12 inches for the same months.

The deep rooted idea that change of the moon causes change in the weather, is believed in by many, but is not our purpose here to discuss its truth or not; but it may be mentioned that there is one fact which deserves the attention of those who rely upon popular theories, and this is, that they do not invariably hold good in different places.

For instance, in England, a rhyme runs :—

"When the moon lies on her back,
Then the South-west wind will crack,
When she rises up and nods
Brisk North easters dry the sods."

In Trinidad the moon may be "on her back" but no South-west wind result, as we seldom get such a wind, but the very opposite is generally the case, and North-easters frequently prevail when "the moon is on her back."

We find in the old Kentish rhyme :—

"Cherry year, Merry year,
Plum year, Dumb year."

This may be distinctly classed with the Trinidad "Balata year—wet year," &c., &c.

The sound of the *Cicada* or Cigale is taken locally as a sign of rain, but the entomologist will show that it is a sign that rain has already fallen, or the Cicada could not have been released from his chrysalis, moisture allowing this to take place.

In all these sayings, as must necessarily occur, there is a portion of truth; that is to say, they are right *sometimes.* Believers seldom count how often, as that which one wishes to believe, is generally more easily accepted than a contrary idea.

An ancient rhyme shows that such ideas, sayings, or theories, had their opponents, as well as their believers, years ago, as well as in the present day and we quote it for those interested :—

"The moon and the weather
May change together
But change of the moon
Does not change the weather.
If we'd no moon at all
And that may seem strange
We still should have weather
That's subject to change."

It is our part to record weather as it comes, and it is our experience that the perusal of tables of authentic records upsets many theories as to weather, often show them to be unreliable, and that in general the weather is as variable a quantity in Trinidad as in other countries and cannot be foretold with any certainty.

Countries possessing telegraphic communication with distant central meteorological stations, can by electric communication, ascertain what kind of weather is prevailing at a distance, and by a study of the air currents, they can issue forecasts which are mainly correct, and are of great value, but it is only in the hurricane season, that even this is followed in our tight little island. All other prognostications rest not upon information, but upon something infinitely less reliable, and to call it guess work would not be far from the truth. *Sometimes* the guess comes true, when it does, the guesser is to be congratulated. Our own guesses, we are not ashamed to say are often far from correct, but we sometimes guess right, and then we think as much of it, as our friends do.

631.—RAPHIS FLABELLIFORMIS, *Ait.*

This little palm thrives especially well in the Trinidad Gardens, and being stoloniferous, soon appears as thick clumps wherever planted. It is especially useful for forming hedges or screens, which are very effective, require little care, and never become overgrown beyond a hedge six or eight feet high. It may be transplanted readily from the large clumps at most seasons of the year.

In pots and tubs, it supplies decorative material of no mean order.

632.—NEPHELIUM LITCHI, *Ait.*

Trees of this fine oriental fruit have been growing for many years in the Botanic Gardens.

There is no record of planting, but the trees are estimated to be at least 30 years of age, or perhaps as much as 10 years older.

They have fruited on but three occasions during the incumbency of the present Superintendent *(17 years)* and it is some years since the last fruit was produced.

The trees flowered during the "dry season" and showery weather having prevailed during that period, it is considerable probable that the crop of fruit, is owing to this occurrence.

The fruit produced was small in quantity, but excellent in quality, and a good supply of plants have been raised from the seed.

633.—A LARGE BANANA.

On one of the "Cacaó Contracts at the Government estate at Diego Martin plants of *Musa Cavendishii* or Chinese Banana, are grown as shade.

One of the plants it appears "fell upon good ground and brought forth abundantly,"—as Mr. J. C. Augustus, the officer in charge, was able to send down a bunch of thirteen hands, many of which had over twenty fingers. The total weight of the bunch, as sent down to this office from the estate was 134lbs. The bunch was over 3 feet in length and the diameter was some 18 inches.

This kind of Banana is known in Trinidad as *Figue Governeur* or Governor Fig. It is known in Jamaica as Chinese Banana and elsewhere as Cavendish or Canary Island Banana.

The Trinidad Legislature has recently voted a special sum for the maintenance of a Banana Nursery and Experiment plot at *River* Estate.

634.—PACHIRA AQUATICA, *Aublt.*

This tree is a common one in the forests and margins of lagoons in Trinidad. In the interior it is known "as Cacao Maron" or wild cacao, and has been brought to us as a new species of Cacao on more than one occasion. An instance was recorded in Bulletin, Vol. III, Article 248, of July, 1897. In that article the tree was recorded as *Pachira insignis, Sav.* There are two species in Trinidad *P. aquatica, Aublt.* and *P. insignis, Sav.* which having been referred by the Demerara Authorities and these gardens, to the Herbarium Authorities of Royal Gardens, Kew; it has been determined that the names have been transposed. The wild cacao must in future therefore be *P. aquatica* and the larger species *P. insignis.* Both trees produce large seeds which are known as *châtaigne* or chesnut, and are eaten roasted or boiled by the peasantry.

635.—BOMBAX EMARGINATUM, *Dcne.*

Many travellers make the mistake of calling all the "Silk Cotton" trees Bombax. The Common West Indian cotton is however produced by a tree known as *Eriodendron anfractuosum,* D.C., which is a very large tree with peculiar buttresses at the base of the stem, which may be seen lying exactly beneath, and acting as a support for the large horizontal branches.

Bombax emarginatum also produces cotton, of a similar kind, but more silky and better esteemed for Upholsterers use, than the silk cotton of Eriodendron, known in commerce as " Kapok."

A specimen of this Bombax is to be seen in the Botanic Gardens and also in front of the new Mansion of Leon Agostini, Esq., on the Maraval Road, where it was planted on land formerly belonging to the Government, but now sold for building purposes.

636.—FUNTUMIA ELASTICA.

This Rubber continues to thrive at the Experimental Station St. Clair and has again this year produced a fine crop of seed which has sold readily. The trees are now some 30 feet in height although only some 6 years of age. Rubber of good quality has been extracted from them, the analysis of which was published in our issue for January of this year.

637.—OTHER USES FOR CARBON BI-SULPHIDE.

Among the many uses to which this chemical can be put. are the following:—

1. The destruction of boring beetles in Cacao trees.
2. The destruction of land crabs in estates near the sea.
3. The killing of insects, for entomological specimens.

In the first two cases it is only necessary to saturate a small plug of cotton wool with the liquid, place in the holes and cover to exclude air.

For insects, a few drops should be poured on blotting paper at the bottom of a wide mouth bottle, the insect placed inside and allowed to remain from one to three minutes. A longicorn beetle was most effectively given his *quietus* in less than two minutes by the writer while engaged on the present article. The body of the insect was over 3 inches in length.

Land Crabs have been most effectively destroyed at the Botanic Station, Tobago by this method.

638.—COTTON.

During the past season several experimental attempts have been made to grow cotton with more or less success.

The trial at the Experiment Station, St. Clair, for 1903–4 was not of sufficient extent, to warrant a detailed description; but it may be recorded that " Sea Island " Cotton proved a failure, through the attack of various insects on the bolls, causing them to rot upon the stem. A simliar attack appeared on Kidney Cotton with like results, while in a cottage garden not many chains distant, plants were unaffected, which fact is strong evidence that our land was specially infested with certain insects. The " Upland or Creole Cotton did not suffer from like attack, but a sample of Lint was produced from it which has been

valued in London at 9d. per lb., and was spoken of as superior to American "upland." * A small plot of "Sea Island" Cotton was sown in November as an experi- ment to ascertain its behaviour while ripening in the wet season. Pods ripened May and June, but fully 75 % rotted. Plants quite healthy.

From Princes Town district better results have been recorded. but from Orange Grove and other districts similar records have been obtained to our own. A consignment of 449lbs. of Sea Island (seed cotton) from Princes Town was ginned by the Botanical Department for which the price of one shilling and threepence per pound was obtained. The details of cultivation area, &c., not being furnished, we are unable to state the return made to the cultivator.

The ginning machines provided by the Government at St. Clair are in excellent order and the baling press is available. These are hand machines only, but have proved sufficient for the present season.

A supply of over 2000 lbs. of the best quality of "Sea Island" cotton seed has been imported through the good offices of Sir Daniel Morris, K.C.M.G., for the ensuing season and a large amount has been distributed, one applicant taking 300 lbs.

Under instructions from the Government several experiment plots of cotton are being started during the coming season, at Diego Martin Reformatory, River Estate, Cedros, Dabadie, and St. Clair, on all of which "Sea Island" cotton will be tried. It is hoped to prove with these whether the "Sea Island variety" is suitable for cultivation in Trinidad. Hitherto the trials have been decidedly unfavourable. Measures are also being taken for the hybridization of the "Sea Island variety" (when it comes in flower next season,) with the better acclimatized forms, with the view to secure a cotton possessing the best qualities of both kinds. I consider it quite probable however that the results of this year's trial may be reversed next season. Considering the importance of the matter, these trials will be carefully carried out. for it is quite certain, that if "Sea Island Cotton" can be successfully grown, it will give a far better return to the cultivator, than the upland varieties. As to its thriving; the most that can be said is: "If it will it will, you may depend on't. If it wont; it wont and there's an end on't."

The writer had the privilege of an invitation from Sir D. Morris to witness the Ginning machinery in operation in Barbados and St. Vincent and a copy of the Official report thereon is attached for general information.

The Cotton Factories at Barbados and St. Vincent.

"On the invitation of Sir Daniel Morris, K.C.M.G., and with the approval of His Excellency the Acting Governor, I proceeded to Barbados by the Mail of May 6, for the purpose of witnessing the operations carried on in the cotton-ginning factory at Bridgetown, established by the Imperial Department of Agriculture.

"Communicating immediately on my arrival with Sir Daniel Morris, I was able to make arrangements to see the gins at work on the morning of Monday May 10. On arrival at the factory, I was met

* See page 84.

by Mr. J. R. Bovell who was kind enough to show me the machines in operation and to explain their working in full detail.

"As described in the *West Indian Bulletin*, Vol. IV, p. 317, the Barbados factory consists of six single-action roller Macarthy gins (Platts) and a hand power baling-press. My visit was timed to enable me to see the factory in full work and the first impression I received was the business-like character of all the operations. There appeared to be an abundance of raw cotton waiting to be ginned, and the machines were rapidly turning it into clean and marketable produce, in bales of 250 to 300 lbs. each.

"Mr. Bovell explained that, on the delivery of the cotton, each grower was given a receipt for the gross amount of seed-cotton delivered at the factory, and when the work of ginning was complete, the grower received a statement showing the net weight of lint and seed produced, after deducting for any loss which occurred in the operation. The cotton is at once baled and addressed ready for the market. It is sent on to the British Cotton Growing Association, which undertakes to dispose of the parcels to the best advantage of the producers.

"The working of the power gin was thoroughly examined, and the most important features were clearly pointed out to me by Mr. Bovell. There appears to be little difficulty in obtaining operatives, and I am informed that they rapidly acquire the necessary skill. Each gin is attended by one man to feed and one woman to pick and dispose of the cotton as it leaves the machine.

"The seed is crushed by a roller mill and is returned to the growers for cattle food; most of the present season's seed has been treated in this manner, as it is intended to use imported seed for the next crop.

"As the full statistics of the Barbados factory will be published in due course, it is unnecessary to enter into details in this report. It may be mentioned, however, that the cotton appeared to be of excellent quality, and the manipulation all that could be desired. The soft and silky cotton coming from each machine at a regular speed proved that they were working smoothly and well, and at a rate which caused the single baling press to be kept going at its best speed all the time.

"Having to pay a visit of inspection to the Tobago Botanic Station I returned by the Intercolonial Steamer, which enabled me to land at St. Vincent and inspect the factory in that island. Sir Daniel Morris being on board, I was able to accompany him on his visit to the factory, which is situated a short walk from the landing place. The inspection showed an admirably arranged three-story building with six gins at work and plenty of cotton to work upon. This mill, I was informed, is considered by Mr. Seabrook, the American ginning expert, to be fully equal in its arrangements to any in the United States.

"The factory was in full work. The gins are of three different makes—two Platts, two Dobson and Barlow, and two Asa Lees. The gins, like those of Barbados, are some 40 inches in width, and their capacity has been estimated to be 300 lb. of lint per hour for six gins, or 50 lb. per hour for a single gin. The hand gins imported for use

in Trinidad are roller gins of Platts make, and are about one-third the capacity of the power gin when driven at the same speed. They can be worked by power and are supplied with parts for that purpose. I was informed that hand gins can never be expected to do as good work as power machines, on account of the unpreventable variation in speed which occurs with hand labour. The Trinidad hand gins have, however, performed all the work they were called upon to perform during the present season, and their work appears to compare favourably with that done in other colonies. If, however, a large area is planted in Trinidad during the coming season, they will not be sufficiently powerful to deal with the crop, and further provision would have to be made to meet the wants of growers.

"On enquiry I find that in none of the islands are advances made for growing cotton, but that full provision is made for ginning and marketing all that can be produced: it is considered a better policy to assist the industry by such means than to make direct advances to the growers.

"I have, in conclusion, to record my appreciation of the kindness of Sir Daniel Morris in inviting me to inspect the working of the cotton factories under his department, and for the personal trouble he took to ensure that I should make myself fully acquainted with essential details of the machinery and the methods of work which have been so successfully adopted."

639.—CLAYING AND POLISHING CACAO.

In the preparation of Cacao no hard and fast rules can be laid down. A great deal depends upon the method adopted for conducting operations during changeable weather, and the requirements of the market sometimes compel the planter to modify his usual style of curing. The object of the following notes is to place before those interested in "Clayed cacao" the fundamental principles upon which the making of a choice sample of this class of Cacao chiefly depend.

SWEATING OR FERMENTING.

Upon this operation the colour and quality of the sample in so far as it rests on preparation alone, will mainly rest; and it may be termed the foundation of a perfect sample. The quality which is obtained by use of our process is that known on the market as "Fine.'

The object to be attained, is the making of a sample that will become known on the market as being the produce of a certain estate which will always command the highest possible price in the market. This should be the pride of all estate owners and managers. To obtain such results it is essential first of all that the beans should be allowed to ferment not less than 8 to 10 days.

Supposing the cacao is placed in the sweating boxes on a Saturday, it should be turned on the Tuesday and Friday and not taken out until the Monday morning following, which will give a clear nine days fermentation. On each occasion when the beans are turned, great care should be exercised to see that the top beans go to the bottom and the bottom to the top, and the outside beans to the inside. This

will assist greatly in obtaining what is known as an even ferment. A sample thus treated will be observed to take on a clear mahogany colour, and upon opening a bean, instead of its being "cheesy" as is usually the case with unfermented material. the interior will have the appearance of leavened bread, *i.e.*, having air spaces traversing the entire beans, and the two conditions may justly be compared to leavened and unleavened bread. It is generally believed, that to ferment for as much as 8 to 10 days is somewhat risky, as in wet weather the sample will be in danger of being spoilt. This idea is erroneous, for it will be observed that a highly fermented sample has much less gum and moisture about it, and therefore takes a shorter time to dry; in fact, half the amount of heat necessary for drying an unfermented sample in a given number of days, will dry a well fermented one.

DRYING.

As soon as the Cacao is placed on the drying floor labourers should be started to clean it, removing all black grains wherever seen. This being finished it can be left with the dryer, whose duty it is to keep walking through it, turning it with his feet in a simple but well known manner, which allows all the beans to have the same exposure to the sun. It is advisable to keep the beans in a layer not less than 3 to 4 inches in depth upon the drying floor, for the first two days in dry weather. Should wet weather prevail the planter will here have to bring his own common sense and experience into use and take every advantage of the weather to dry his beans as quickly as possible. One of the chief rules in drying is to take special care to dry the floor of the drying house before spreading the beans upon it. This will be always found necessary, for once the dryer has a dry floor to work upon, rain may fall for several days but the sample will stand little risk of being spoilt.

The floor may be dried by moving the cacao about the floor, and gathering the wet beans together in small heaps every two or three hours, thus allowing the sun to dry all uncovered floor spaces. Thus treated the beans will be found the following morning to be quite free from mildew. If kept on a wet floor continuously Fungi or mildew is sure to be produced.

CLAYING.

In good weather it is generally found that the second day after exposure is the best time to apply clay. The red clay used for this purpose in Trinidad is found in quantity on several estates. This material should first be well dried in the sun after which it must be pulverised in an ordinary wooden mortar, reducing it to a fine dry powder, which when finally sifted, will be but little coarser than wheat flour. When reduced to this state it is ready for use. In our process a dry powder is always used, but some operators advocate its application in a liquid form. The latter method in our opinion does not give such good results as when the clay is applied as a dry powder. When applying the clay the beans should be drawn together in small heaps of about 2 barrels each, and men should be chosen weighing not more than 120 to 140 lbs. to tread or dance on the top of the heaps with naked feet while women and boys sitting around the base of the heap repeatedly throw up the

beans as fast as they are thrown down by the dancer. While this operation is proceeding, the powdered clay should be applied by dusting it over the heaps with the hand. The exact amount to use cannot be accurately stated and can only be learnt by experience, but the novice may take at his standard some 3 lbs. to the barrel. It will be noticed during the operation that owing to the beans being still wet and gummy, the clay adheres readily. On the first application the beans need not be danced to a polish, but just enough to allow of an even distribution of the clay. The heaps must then be opened out and allowed to continue drying. The following morning, it should be again danced, when the beans will be found to be much dryer than on the previous day. The heaps should be kept thick under the tread of the foot, to prevent their being crushed and the dancing should be continued until the sample is highly polished, and has assumed the appearance and colour of polished mahogany. The secret of retaining the polish lies in the treatment after this last dance.

The heaps should be opened thinly on the drying floor and allowed to receive the full action of the sun for 5 to 6 hours, which fixes the polish on the beans. It has been repeatedly observed that unless strong sunny weather is obtained after dancing the polish usually fades and becomes somewhat dull.

After the operator has succeeded in retaining the polish, it simply remains to continue drying until the produce is ready for market. The following are the advantages and disadvantages of using clay in a dry and wet condition :—

1. When used as a dry powder, the clay at once assists in the drying of the beans, it absorbs a great deal of the moisture and helps in securing what is known locally upon estates as "Cutting the Gum."

2. The sample prepared with dry clay seldom runs any risk of being spoilt.

3. It is easier to obtain a high polish with dry clay than by other methods, especially if the operations described in this paper are carried out after the last dance.

The disadvantages of using clay mixed with water are as follows :—

1. Great risk is run after the sample is once dry, to wet it again, for should there be continuously dull weather for a few days after its application, there will be a great risk of having the whole sample badly damaged. It is better to avoid wetting cacao when once partially dried.

2. The clay adheres better in the dry method.

3. The operator will never get as bright a polish by using the wet as he can by the dry method.

4. A much larger number of beans will be crushed or damaged if the wet method is used.

In fair weather, a sample treated by the dry method should be perfectly cured and ready for market in four to five days.

After dancing with clay the drying floor should be well scraped to remove the mixture of clay and mucilage which usually collects on it. If this point be not attended to the floor will be observed to be quite damp on the following morning, which is due to fermentation and decomposition of this mixture, and the quality of the cacao will suffer.

The expense of treatment by the process now described, above ordinary methods is but trifling, and well repays the planter in returns obtained.

Cacao prepared by this method keeps better, owing to the clay and mucilage forming a thin protective coating which prevents the attack of mould fungi. It carries better, and breaks less in the bags, as the strong binding of mucilage makes the skin of the bean better able to resist pressure. That, the method is appreciated by buyers is shown by the produce generally bringing higher prices than unclayed Cacao.

Samples of "Good ordinary" prepared after this method by the writer recently sold locally at $13 60 per *fanega* of 110 lbs. and expert opinion of their value is published in this issue under article No. 625.

J. C. A., River Estate.

TRINIDAD. No. 44.

BOTANICAL DEPARTMENT.

BULLETIN

OF

Miscellaneous Information.

(QUARTERLY.)

OCTOBER, 1904.

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Edited by the Supt. Botanical Department:

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640.—PRUNING TREES.

THIS heading covers a large subject, but it is proposed to confine our remarks in this instance to the pruning of Pasture and Street trees, sometimes called "lopping." It should be understood however, that methods of pruning differ in accordance with the object to be attained.

In the Forest the object is to secure straight clean stems. The rule in the Pasture is to secure large trees with spreading branches which afford shade. In fruit trees form and shape is in a certain degree sacrificed to productiveness, while, in pruning ornamental trees the health of the tree is sometimes sacrificed to suit the fancy of owners or growers who may wish them to appear in some particular form or shape.

The close observation of a natural Forest shows how Nature prunes to enable trees of certain classes or kind to reach conditions of light and air conducive to their continuance in health. Wherever trees or shrubs are planted close together, there is sure to be found a tendency in them to become tall and little branched owing to the side branches dropping off from want of light and air, while if planted wide apart where the branches have room to develop; the tree beeomes umbrageous or spreading. This is due mainly to the endeavour of the plant to seek light and air, in order that the leaves may be able to manufacture the material for plant growth.

In pruning away the large branches from street trees, it is necessary to observe great care.

The following tools are necessary :

1st—A "wide set" hand saw, well sharpened.
2nd—A coil of strong rope.
3rd—A ladder of sufficient length.
4th—A well sharpened axe.
5th—A cutlass.
6th—A pot of Coal tar and brush.
7th—A broad chisel.

When it is determiued to cut off a large limb, the first thing to be done is to lighten the weight of same by trimming off its smaller branches and leaves, and then to secure it by fastening the rope about midway of its length so that it will balance when cut, the free end of the rope should be passed over a crutch of a higher and stronger branch and thence to the ground, where it should be secured by a workman around the base of any other tree, so as to enable him to take the weight of the branch as it is severed from the trunk. The branch should then be cut with the saw or axe some two or three feet from the point at which it is desired to remove it leaving a stump some two or three feet long. The object of this is to prevent the tearing or stripping of the bark, which would otherwise take place, when the weight of the branch causes it to fall. Supported by the rope, the only stripping which will occur will be on the two foot stump, but as this is eventually to be removed, it will not matter. When the branch is cut through and lowered gently to the ground,

the stump which is left should then be cut away, first securing it in the same manner and lowering and supporting its weight by the rope while cutting.

Begin the cutting of the stump by making a cut with the saw on its underside, and then finish by cutting quite close to the main stem from above. As soon as the branch is removed, the chisel should be used to clean and smooth the surface of the wound, which should then be covered with a coating of coal tar.

The object in cutting the branch close in to the stem, is to enable the tree to heal the wound by a growth of cambium from its edges, which will eventually cover and secure it from the weather. If a stump is left, it will assuredly die back, and the dead wood remaining in its centre will prevent the cambium from growing and covering up the wound. Smoothing with the chisel prevents the lodgment of water, and the coating of coal tar preserves the wood by keeping off the spores of microscopic fungi which cause decay. The cut should always be made in a sloping direction, so as to shed any water that may fall upon it.

In the Herbarium of the department is a specimen of wood taken from a tree, from which a branch had been cut in this manner in the time of my predecessor, Mr. Prestoe, the wood of which is quite sound. After healing the cut has been covered with a growth of six inches of solid wood.

This is represented in the following line diagram :—

Line Diagram showing the principle of pruning, to be adopted to allow of wounds healing over.

The actual branches which should be removed, must be determined by circumstances, no one could possibly tell how in writing, and it is best to learn by practical observation under a good pruner. Anyone can cut and lop a tree, but a good pruner is more difficult to find. As a rule the tree should be left perfectly balanced, and all inferior and useless branches removed. The lopping of branches from a tree with a cutlass, can only be considered as *barbarous* treatment, and it is certain that more deaths among trees are caused by this practice than from any other cause.

In cases where a branch has fallen naturally owing to the extra weight added by a heavy crop of seed, or rain water, (as frequently occurs with some of our brittle woods—such as the "Carap") the wounds should always be attended to where practicable, by cutting clean back, and tarring the wound. In places where, from the decay of a broken branch, a hole or opening occurs into the bole of a tree which will admit rain water, the life of such a tree may be lengthened by some years if such aperture is filled with ordinary Portland cement and smoothed over.

People are careless at times in pruning, and it is often pointed out that it is too expensive to prune in the manner described in this paper, and the cutlass is resorted to. Such practice cannot be too strongly condemned, as it is well known that it will assuredly end in premature destruction. Although they may live to a certain age under such treatment, it is still quite clear that trees would last many years longer if the services of trained men were employed for carrying out such operations.

A tree should be treated as a living thing, and should no more be tortured by the hacking of a cutlass, than should a member of the Animal Kingdom; the danger to its life being quite as great, if treated to such practices. Treat trees kindly, and where amputation is necessary or requisite, let it be done by methods which will do least harm. *The less a tree is cut, the longer it will live,* and therefore all pruning should be done with due regard to the preservation of its life for as long a period as possible.

641.—A PURPLE LEAF CANE.

One of the young men attached to the Experiment Station brought in about two years ago, a cane with a diameter ranging from half to three quarters of an inch, bearing leaves dark purple in colour. In all probability, no great importance attaches to find, but it is interesting to note the great difference between it and the ordinary canes of Estates. Planted among other canes, it looks like a black spot at a little distance.

The cane itself has considerable saccharine matter, and has a peculiar flavour, with a slight though perceptably bitter taste.

We have no account of its origin, and hesitate to pronounce upon its affinities.

If any of our readers can enlighten us we should be grateful.

642.—PROGRESS OF SEEDLING CANE CULTIVATION.

The growth and progress made in the cultivation of seedling canes, is somewhat remarkable. There is no longer any doubt as to their value, and thousands of acres are being planted in all sugar growing countries. Demerara is believed to lead in number and extent of the acreage planted. Trinidad is not altogether behind. one planter informing me (September) "I have over 2,500 acres of seedling canes for coming crop." This is encouraging, and the confidence inspired will render it much less difficult to get selected canes tried on estates than hitherto. Wanting Departmental arrangements for the purpose; this has hitherto been one of the chief difficulties in Trinidad.

643.—ON THE BUDDING OF NUTMEGS.

In countries where the science of agriculture is most advanced, no practical fruit grower would plant out seedling trees, except, perhaps, with the ulterior intention of budding or grafting upon them: this is due to his knowledge of the fact that the seedlings have an inherent propensity to vary, and in addition to this is the possibility of the seed having been cross-fertilized with an inferior, or perhaps, wild variety; and further, a seedling takes much longer to produce its first crop than a grafted or budded tree. Now the nutmeg seedling has still another disadvantage: it not only takes some seven or ten years to yield its first crop, and may bear inferior nuts then, but there are ten chances to five that it will not bear at all! After years of weary waiting fifty per cent. of the trees in a plantation of seedling trees may prove to be male or non-bearing trees.

The seedling nutmeg then is simply surrounded with uncertainty; and it is with a view to doing away with this uncertainty that experiments in budding have been conducted at Hope.

Several years ago grafting by approach was successfully carried out, but this method could not be taken up commercially on account of the scions continuing to grow in a somewhat horizontal direction in much the same way as they would have done had they been allowed to remain on, and as part of the old tree, instead of growing upright as a seedling does; they failed to grow into profitable trees.†

It then became evident that some means must be found for utilizing the central stem of the tree as scion wood, since it and its buds alway grow in a vertical direction; some trees were accordingly cut down to within 3 ft. of the ground and encouraged to sprout, and in a short time each had four or five stems growing vertically and producing horizontal (primary) branches in whorls of five up their entire length in just the same way as a coffee tree does when it is stumped down, though in this instance two primaries are produced at each node; each stem would have made a complete tree, and since they were buds on the main stem it was reasonable to suppose that the buds on the stems would grow into complete trees too. The method employed was that described in the articles on the budding of Mangoes and Cocoa,* the only difference being that the whole of the bud is to be covered with waxed tape, that greater care is

*Bulletin of the Department of Agriculture, Jamaica, Nov. 1903, pp. 253–257.

†We do not follow the opinion of the writer in this respect. (Ed.)

required in fitting the bud, and the least possible time should elapse between the cutting out of the bud and fitting it into the stock.

Within the last ten years nearly three-quarters of a million nutmeg seedlings have been distributed from Hope Gardens, and many will probably soon flower for the first time; as the male trees "declare" they should be marked for budding upon later, using as bud-wood the vertical shoots of a female tree that had previously been cut down, selecting a tree for this purpose that is known to yield nuts of first quality, 60–80 to the pound.

It would be well to remember, however, that about four per cent. of the trees in a plantation should be male trees to provide pollen for fertilizing the female flowers; and these placed on the windward side of the nutmeg walk so that the pollen may be blown among the female trees. Old useless male trees may be cut down and the resultant shoots budded upon.

T. J. HARRIS.

644.—VARIETIES OF SUGAR CANE.

By C. F. Eckart.

(Experiment Station and Laboratories of the Hawaiian Sugar Planters' Association Press Bulletin No. 1.)

Probably no subject pertaining to the cultivation of cane in the Hawaiian Islands during recent years, has held more interest for the planters, in various localities, than that relating to the introduction and trial of new varieties.

In the Hilo and Hamakua districts, the Lahaina first made way for the Rose Bamboo, and the latter, after a strong stand for many years, is now being rapidly succeeded by the more vigorous Yellow Caledonia. This cane with its upright growth and deep rooting propensities has proved a most valuable acquisition in wet and dry localities alike. Growing erect, with a natural tendency to shed its dry leaves, it becomes an admirable cane for rainy districts, where varieties that are prone to fall to the ground and remain in contact with a frequently saturated soil have shown extreme sensitiveness. The frequent stripping, required for Lahaina and Rose Bamboo in these wet places, has necessarily added to the cost of cultivation, and the ready manner in which Yellow Caledonia tends to strip itself is no small item in favour of economy. Again the manner in which it keeps down weeds, which were such a menace to its predecessors on the unirrigated plantations, is another strong point in its favour. In dry districts subject to occasional drought, it has amply demonstrated its hardihood over Rose Bamboo, which in turn is more resistant to such unfavourable climatic features than Lahaina. By sending its roots down deep into the soil it draws from a larger reserve supply of water than the older varieties, which are more shallow feeders and which soon feel the effects of a rainless period.

The substitution of hardier varieties, in localities subject to varying and adverse weather conditions with their train of insect and fungus depredations, as well as the constant aim to produce a cane of higher sucrose content, less fibre, and superior milling qualities in more favoured regions, has formed a subject for continued investigation in nearly all sugar growing countries. Within the past ten years

we note the passing of Rappoe (our Rose Bamboo) in certain districts of Queensland, where through gradual deterioration it finally reached a stage when it could no longer cope with diseases from which it had previously suffered but little damage. In 1890 the Bourbon (identical with the Lahaina), which had grown for many years as the standard variety of Barbados, began to be replaced by varieties which showed a greater resistance to disease and insect attacks, and we note a favourable report concerning Caledonia Queen, Striped Cane, Queensland Creole, etc., with regard to their immune characteristic. To-day a superior variety and a seedling has come to the front under the name B. 147 and has become firmly established as the standard cane of Barbados and other points in the West Indies.

The introduction of new varieties into the various sugar-growing countries of the world, while attended with profitable results in many instances, has given rise to considerable confusion regarding their nomenclature. Often, on becoming established in their new homes, the canes receive local names, which in time entirely replace those under which they were imported. A signal success with one of these newly introduced varieties, under its new environment, results at times on its being returned, on request, to the country in which it originated, under the impression that it is a new cane with valuable qualities, and consequently worthy of trial. Naturally this change of habitat is productive of certain modifications in the cane, which, though superficial in some instances, cause it to be grown for many years along side of its near relative, descended from the same stock, before it is identified as the same variety. We thus find our Lahaina passing under the name of Bourbon, Colony Cane, Otaheite, Loucier, Portier, Bamboo ii. China ii, and Cubian. The Rose Bamboo has received the appellation of White Transparent, Caledonian Queen, Blue Cane, Light Purple, Rappoe, Mamuri, Hope, and Light Java.

It is interesting to note the changed characteristics of the same variety after having been subjected to different soil and climatic influences during many years. For instance, if we compare our Lahaina, introduced into these islands from the Marquesas Group by Captain Pardon Edwards, and the Otaheite, received from Louisiana some years ago, it appears that they came from the same stock. From the coast of Malabar, India, this variety (for they are the same) was shipped to Reunion, Mauritius, and Madagascar, and from these points it was received by the West Indies and the islands of the Pacific. From the West Indies "Otaheite" was introduced into Louisiana and from Louisiana into Hawaii, while the "Lahaina" came from the other direction and reached Hawaii by way of Marquesas. When brought together at the Experiment Station and grown side by side under the same conditions of soil, climate, irrigation and cultivation they resembled each other closely and only differed in their value as sugar producers and in the diameter of the stick. A comparison of these canes at the Station may be shown by the following figures:—

	Lahaina.	*Otaheite.*
Cane per acre	116,015 lbs.	... 120,516 lbs.
Sugar ,, ...	18,377 ,,	... 13,450 ,,
Fibre	11 %	... 10 %
Brix of juice	19·62	... 15·0
Sucrose of juice... ...	17·8	... 12·4
Purity of juice	90·72	... 82·28

In 1903 a small lot of Otaheite was harvested which made a somewhat better showing than the above.

The difference in yields and other characteristics, manifested by the same cane under different climatic conditions, indicates forcibly the necessity of experimenting with a variety in as many localities as possible before it is condemned as a poor sugar producer in these islands. This point is brought out most clearly in the case of the Yellow Bamboo, which thrives at high elevations in Kau and at a point where Lahaina would prove a failure. At the Experiment Station, on a low level with corresponding differences of soil and climate, the Yellow Bamboo produces only one-half as much sugar as Lahaina. Another good illustration of this point is amply afforded by the Salangore variety. In the Straits Settlements, after being tried in competition with many varieties, it was found to take the lead with Lahaina standing second. Grown at the Experiment Station in Honolulu, Salangore made but a poor showing compared with other canes, and owing to the limited area of land was dropped from further trial in order to make room for more promising canes.

Salangore at the Experiment Station :—

Cane per acre	95,832 lbs.
Sugar ,, ...	13,081 ,,
Fibre in cane	11·37 %

Juice analysis :

Brix	17·67
Sucrose	15·4
Purity	87·15

Climate and soil are the paramount influences exerted on the sugar producing capacity of different varieties, and of these two conditions it is difficult at times to note which has the more determining effect on crop production. At a central station where varieties are grown on the same soil, a different order as regards their yields is often manifested from year to year, and if attention to this change in the scale of production is supplemented by a careful comparison of weather conditions during separate periods, an indication is afforded as to the localities in which certain canes may profitably be tried. Another cause which tends to change such an order among varieties is the difference in the rapidity in which canes become acclimatised. One which becomes adapted to its new environment more quickly than another, is not necessarily going to hold a superior position over the other when it in turn has gradually become accustomed to its new home.

A difference in the time of maturing may also prove prejudicial to the showing some varieties may make when grown in competition with others, and this point is worthy of consideration. For instance, if we cut all of the varieties at one time (as is usually done) for the purpose of comparing their relative productiveness, some of them which matured earlier than others, may be already "going back" as we say, and this brings them into unfavourable comparison with the more slowly maturing canes. Demerara No. 95, for instance, has been observed to deteriorate rapidly after it has become fully ripe. This difference in the rate of maturing must also affect in some measure the vitality of the seed cuttings. For instance, if we are growing a dozen varieties for seed to be planted out in competitive

plot experiments, it can readily be seen if these are cut at a certain age (say at 11 months) some varieties will furnish more mature cuttings than others and consequently the eyes germinating with different degrees of vitality will influence the ultimate yields of sugar.

Such considerations as the above make it necessary that varieties shall be grown in competition through a number of seasons before we attempt to draw conclusions as to their relative worth and take one from among the rest as a standard cane.

At the Experiment Station a number of varieties were recently harvested and the weights of each were taken from an area sufficiently large to indicate their respective merits under such conditions as obtained at the Experiment Station during 1902–3. The yields were as follows :—

Variety.	*Sugar per Acre.*
Demerara No. 117	26,540 lbs.
Cavengerie	25,995 ,,
Striped Singapore	22,661 ,,
Queensland No. 1	21,878 ,,
Yellow Caledonia	21,808 ,,
Louisiana Purple	21,232 ,,
Queensland No. 7	21,100 ,,
Big Ribbon	19,812 ,,
Demerara No. 74	19,354 ,,
Louisiana Striped	19,067 ,,
White Bamboo	18,604 ,,
Tiboo Merd	18,044 ,,
Queensland No. 4	15,996 ,,
Demerara No. 95	15,158 ,,
Queensland 8A	14,622 ,,
Gee Gow	14,402 ,,
Yellow Bamboo	12,307 ,,

The Fibre stood as follows :—

Variety.	*Fibre.*
Cavengerie	12·7 per cent.
Gee Gow	12·2 ,,
Tiboo Merd	10·0 ,,
Louisiana Striped	10·0 ,,
Louisiana Purple	9·8 ,,
Queensland No. 1	10·75 ,,
Queensland No. 4	11·0 ,,
Queensland No. 7	12·5 ,,
Queensland 8A	11·0 ,,
Demerara No. 74	9·8 ,,
Demerara No. 95	11·1 ,,
Demerara No. 117	11·5 ,,
Yellow Bamboo	12·3 ,,
Yellow Caledonia	11·1 ,,
Big Ribbon	11·3 ,,
Striped Singapore	10·3 ,,
White Bamboo	13·1 ,,

Analysis of juice :—

Variety.	*Brix.*	*Sucrose.*	*Glucose.*	*Purity.*	*Gums.*
Cavengerie ..	18·14	15·8	·752	87·1	·60
Gee Gow ...	17·76	16·1	·301	90·7	·39
Tiboo Merd ...	16·23	13·9	1·044	85·6	·44
Louisiana Striped ...	17·56	15·9	·413	90·5	·45
Louisiana Purple ...	17·11	15·5	·381	90·6	·48
Queensland No. 1 ...	16·13	13·9	·978	86·2	·57
Queensland No. 4 ...	16·33	14·2	·845	87·1	·54
Queensland No. 7 ...	18·98	16·8	·205	88·5	·85
Queensland 8A ..	16·91	14·8	·339	87·5	·51
Demerara No. 74 ...	16·47	14·2	·404	86·2	·56
Demerara No. 95 ...	17·43	15·7	·324	90·1	·42
Demerara No. 117 ...	17·16	15·2	·459	88·5	·52
Yellow Bamboo ...	16·99	14·7	·472	85·9	·56
White Bamboo ...	18·54	16·1	·218	85·8	·72
Yellow Caledonia ...	18·74	16·2	·325	8·69	·74
Big Ribbon ...	1(·29	14·7	·549	85.0	·64
Striped Singapore ...	17·36	15·5	·563	89.3	·48

Demerara No. 117 still holds the lead among the recently introduced varieties, and is a promising cane worthy of trial under the diversified conditions of the islands. Yellow Caledonia, Demerara No. 74, Cavengerie, Striped Singapore, Queensland No. 1, and Queensland No. 7, also produced heavy yields. White Bamboo, Queensland No. 7, Yellow Caledonia, and the unstriped cane which occasionally appears in a stool of Big Ribbon are closely allied : in fact between White Bamboo and Yellow Caledonia there appears to be no difference, and after four years trial it is impossible to distinguish one from the other.

The following new varieties will be planted out in June of this year and will be harvested in 1906 :—

Striped Tip	Demerara No. 1937.
Daniel Dupont	Queensland B. 5.
Demerara No. 115	Queensland B. 8A.
Demerara No. 116	Queensland B. 147.
Demerara No. 145	Queensland B. 156.
Demerara No. 1135	Queensland B. 176.
Demerara No. 1483	Queensland B. 208.
Unknown	Queensland B. 244.
Dark Coloured Bamboo	Queensland B. 306.

Some of these are very promising canes and have a noteworthy reputation in other countries, chief among them being : D. No. 115, D. 145, B. No. 147, B. 156, and B. 208. Regarding B. No. 147 one West Indian planter writes : "B. No. 147 has the inestimable advantage of being a rough cane outside, with a tough rind, and covered with a coating of dry leaves, which, however, drops off readily when the cane is fully ripe or cut. A spot of this cane which was lately cut for plants, was remarkably free from the common cane borer of which it was very difficult to find a single specimen."

If B. No. 137 sustains its reputation when tried in Hawaii, it will certainly prove a valuable acquisition in some localities.

All of the varieties mentioned in this bulletin as having been cropped during the present year and those which will be planted in June, will be grown for seed for distribution in the spring. It is believed that some of them will be found of value when grown under the various island conditions.—*Louisana Planter.*

July, 1904.

Note.—We propose to discuss this article at a future date.—(Ed.)

645.—CANE VS. BEET SUGAR.

We have been favored with the following communication from Messrs. Crossfield, Ltd., Liverpool, on the above subject:

Is there really any difference between cane and beet sugar?

This question was asked a few weeks ago by one of the leading family grocers in the West Riding of Yorkshire, who had bought beetroot sugar and received a guarantee that it contained 99 per cent. of "cane sugar."

A sample had been submitted by the buyer to an analyst who declined to say whether the sugar was made from beet or cane.

Mr. Richardson, F.I.C., F.C.S., etc., the well known consulting chemist and analyst for Bradford, Dewbury, etc., was therefore consulted. Mr. Richardson has made sugar and its properties his special study and is about to publish an exhaustive work on sugar, so that there could be no better authority to whom one could apply on such a matter.

The confusion occasioned in the minds of buyers by such guarantees and analytical reports with regard to cane and beet sugars was indicated to Mr. Richardson, and it was pointed out that assurances are given by chemists that the two sugars are identical, also that certain interested importers—not refiners—certify their beetroot sugar to contain 99 per cent. of cane sugar.

Mr. Richardson at once grasped the difficulties, and showed so clearly how the misconception and confusion arises that he was asked to write his views in the form of a letter which, with his permission, we have much pleasure in publishing for the information of sugar buyers generally.

City Analyst's Office, Bradford,
19th May, 1904.

Messrs. Crosfields, Limited, 6, Stanley Street, Liverpool.

Dear Sirs—Before beets were generally known cane sugar was the only sweetening material used by the householder, and the chemists of the time always used the expression "cane sugar" as indicative of the chief constituent of the commercial article.

When a substance identical with the sweetening principle present in sugar cane was found to exist in other natural products, for example in the cereals—barley, etc.,—the chemist still continued to use the term "cane sugar" though it was obviously a misnomer, and when beet sugar came into vogue its amount in the article itself or in the solutions made therefrom was always included under the term "cane sugar."

Commercial cane and beet sugars contain absolutely the same sweetening principle, but this is always associated with a small proportion of other substances which communicate a peculiar and indefinable taste, mostly appreciable only to the expert sugar merchant.

I have before me a good cane sugar and a good beet sugar, both show 99 per cent. of pure sugar, known to the chemist as "sucrose," but there remains one per cent. of other substances, which give distinctive tastes to these two articles. In hot liquids, such as freshly made tea for example, this peculiar and distinctive taste becomes very marked When one considers how the merest fraction of a fraction of a per cent. of ethers in wines gives a flavor and a "bouquet," which enable the connoisseur to at once distinguish between vintages of very different values, it will readily be seen that considerably less than one per cent. of organic material in sugars may communicate very perceptibly different tastes to the expert.

Indeed the chemical substances giving the real taste to a variety of foods and beverages are almost always present in very small quantity.

This is the case with tea, coffee, cocoa, beer, wine and spirits.

Believe me, Yours faithfully,

F. W. Richardson.

P.S.—I find myself in thorough agreement with Mr. Arthur Morris on the question of Cane *vs.* Beet Sugar, and herewith return the Journal containing the article.—F.W R.

The reference in the postscript is to an excellent article by Mr. Arthur Morris, which appeared in *The Epicure* of March, 1899; though the whole article is eminently readable, we can give but one or two extracts :—

"All commercial sugars, in fact, are the chemical compound C12 H22 O11, plus certain commercially inseparable chemical impurities.

The difference between cane and beet sugar is thus due to two distinct causes. The more important consists in the proportion of extractives, many of which have a powerful and characteristic taste, found in the molasses, and some of these cling to the refined sugar. It is beyond the refiner's power to prevent it.

The other circumstance influencing the taste of the beet sugar is the large amount of carbonates of potash and soda which it contains as compared with cane sugar. These carbonates exert indirectly a distinct effect upon the flavor of the sugar.

That cane and beetroot sugar are practically identical seems to be the very general opinion of well informed men. There is a difference, and it is all in favor of the product of the cane. A single instance will show that it is not merely a question of prejudice. Alkaline carbonates, even in very small quantities, have a marked effect upon the flavour of many beverages, which it is usual to sweeten with sugar. For example, two samples of the same blend of tea, brewed under exactly the same conditions, with the single exception that one is infused with pure water and the other with a solution of carbonate of soda in a *thousand* parts of water, give beverages differing widely in taste and in aroma. It follows that tea sweetened with sugar containing an alkaline carbonate will not be the same beverage as that made with a sugar free from such admixture. The same effect is noticeable in coffee, and in several other sweetened drinks. Thus it is not merely the fancy of the epicure (and that is important enough) that tells him that cane sugar is the superior article."

While it would be folly to deny that for some purposes refined beetroot sugar is possibly as suitable as cane sugar, especially where merely weight, bulk and color are the only requisite qualities, yet at the same time it can hardly be doubted that cane sugar is superior to beet where sweetness and purity of flavor are valued, where the delicate aroma of tea and coffee may be affected, where the color and keeping properties of preserves are an object, and where the brilliancy and cloudlessness of syrups are essential.

This seems to be tacitly acknowledged through the fact as mentioned above that certain dealers find it is to their advantage to advertise their beetroot sugars as "containing 99 per cent. cane sugar."

> "For ways that are dark
> And tricks that are vain
> The heathen Chinee is peculiar,"

but some English traders seem to run the Chinaman pretty closely for

> "They palter with us in a double sense:
> That keep the word or promise to the ear,
> And break it to our hope."

Surely if they themselves really believed that beetroot sugar was equal in every respect to cane sugar, they would not cloak it in the guise of cane!

It is manifestly un-English for importers of Continental beetroot sugars to take advantage of a misnomer in a technical term for the purpose of deceiving those less well-informed than themselves, but we hope that Mr. Richardson's exposure of the trick may lead to a withdrawal of this subterfuge.—*Demerara Argosy.*

646.—HINTS FOR THE GUIDANCE OF EXHIBITORS AT SCHOOL SHOWS.

Class.	Mode of Preparation, Packing, etc.	Good Qualities.
French or Salad beans.	Pick beans of one length and tie in one or two small bundles with soft twine; 30 to 50 pods are sufficient for one dish.	Half-ripe, straight, long, and regular in shape and size; flesh crisp, without strings or fibre.
Cucumbers.	Pack in box with moss, grass or shavings to avoid bruising.	Brittle, firm, green fruits; should be half-grown, not yellow and with few seeds.
Bunch of Radishes.	Pull from soil evening before show; wash thoroughly and tie 12 to 15 in a bundle.	Should be regular in shape and size; not more than one inch in diameter; skin, clean and free from warts or spots; flesh crisp and free from fibre.
Lettuces.	Cut at ground line and wash clean: remove decaying leaves only; avoid breaking or bruising the leaves.	Regular in size and shape; plenty of heart; leaves crisp and free from spots and bruises—not bitter.
Cabbages.	As lettuces.	Heart should be firm, solid and white.
Melongénes.	Cut with stalks and pack in soft material to prevent bruising.	Fruit should be nearly "full," not ripe; not more than four inches diameter; even colour and outline and smooth skin.
Ochroes.	Pick when half ripe. Less than one dozen should not be exhibited.	Tenderness, with size; should not be tough or fibrous; evenness of shape and smooth skin.
Tomatoes.	See general hints: Pack in shavings, saw-dust, or any soft material that will prevent bruising.	Fruit should be regular in size and shape and free from ridges; smooth clean skin; centre solid, seeds few and small. Fruit of the ridged varieties are judged by size and flavour and are considered inferior to the round varieties.
Sweet Potatoes.	Dig carefully to avoid bruising; wash thoroughly and pack in box with shavings.	Regularity in size and shape; best size, 3 to 5 inches in diameter; skin free from warts, spots or worm bites.

HINTS FOR THE GUIDANCE OF EXHIBITORS AT SCHOOL SHOWS.—*Continued.*

Class.	Mode of Preparation, Packing, etc.	Good Qualities.
Yams ...	Dig up the whole of the tuberous roots of each plant without breaking, bruising, or cutting; wash, clean and pack in soft material to prevent injury; always show whole tubers.	Regularity in size and shape; skin firm and free from disease; flesh mealy and free from fibre and bitterness; dry, not watery when cooked
Cassava ...	As yams.	(*a*) Sweet cassava—not tough, sweet, easily cooked, medium size best. (*b.*) Bitter cassava—size generally.
Plantains ...	See general hints. Pack in box or crate to be carried with stalk of bunch downwards; cut bunch with sufficient stem to bear the weight of the bunch, instead of allowing it to rest on fruit. Place pads of shavings, paper, moss or grass, so that fruit may not touch sides of box.	Ripeness, plumpness, large, "fingers," many and regular "hands;" contour of bunch, cylindrical.
Bananas ...	As plantains.	Flavour, size, colour; form and size of bunch.
Tannias and Eddoes...	As sweet potatoes.	Regularity in size and shape; large, plump tubers; flesh, mealy, dry, and free from fibre.
Peppers ...	Pack with saw-dust in a tin or box.	Regularity in size and shape; flesh firm and fresh; good colour.
Herbs for seasoning:		
(*a.*) Parsley (*b.*) Thyme (*c.*) Mint (*d.*) Celery	Cut and tie in neat bundles.	(*a.*)—Crisp, well curled leaves; (*b.*) (*c.*) and (*d.*)—Compact growth and clean healthy leaves;
(*e.*) Onions (*f.*) Cives (*g.*) Eschalots	Pull and wash; trim roots and tie in neat bundles.	(*e.*) (*f.*) and (*g.*)—Regularity in size and shape; clean, smooth skin.
Turnips ...	Wash well after digging and trim roots.	Regularity in size and shape, single, not branched; skin smooth and free from warts and spots; little or no fibre in flesh,

HINTS FOR THE GUIDANCE OF EXHIBITORS AT SCHOOL SHOWS.—*Continued.*

Class.	Mode of Preparation, Packing, etc.	Good Qualities.
Carrots.	As turnips.	.
Chrystophines.	As melongéne.	As melongéne.
Unenumerated.	*See* General Hints.	
Flowering Annuals in pots	Grow in pots 6 or 8 inches in diameter; pack in box with grass or paper pushed tightly between pots to prevent breakage; plants should have stakes to support the main stem; bamboo strips may be bent over the plants and fixed to the sides of the box as further protection. A box or crate a little deeper than the pots is best.	Well grown plants should have plenty of good flowers, clean healthy foliage and a robust, sturdy habit. N.B.—An *annual* is a plant which comes from seed annually and dies after flowering. *Biennial* plants last two years. *Perennial* plants flower annually but last several years.

Fruits.	Mode of Preparation.	Good Qualities.
Pine Apples.	Cut stems, leaving about 4 inches. *See* that the fruit is mature.	Flavour, size, colour.
Oranges and all citrus fruits. Lemon, Shaddocks, Limes, &c., &c.	Handpick all fruit, do not allow it to fall. Cut stems off short, do not pull out stem.	Flavour, size, colour. Thinness of skin. (Coarse skin is a bad quality).
Pumpkins.	Cut from vines when mature. Do not bruise.	Quality of interior, size, of good quality.
Sapodilla, Star Apple Mango.	Pick when mature or "full." That is to say, when they will ripen by keeping.	Flavour, colour and size.
Water Melon, Musk Melon.	Cut when mature, not ripe.	Flavour and size. Colour of interior.
Bananas, Plantains.	Cut when "full" or mature.	Flavour and size combined.

GENERAL HINTS.

Cut fruits, *i.e.*, bananas, plantains, oranges and tomatoes when "full" or one to two days before the date of despatch, in order to "condition" or "wilt" the skin. When once wilted they can be much more safely handled. Fruits such as oranges and tomatoes should have short stalks left attached to the fruit.

Handle all produce carefully to avoid bruising. A blow that will break an egg will damage and destroy a fruit, although its effect is not at once seen. If possible each kind of produce should have a separate package, but several small packages may be put together in a larger one, if there is no danger of bruising the produce by so doing. Vegetables should be prepared on the afternoon of the day previous to the show or as early as possible on the morning of the show-day so as to have them fresh.

Light boxes such as those used by mustard and sweetmeat manufacturers, biscuit tins and other similar receptacles would be found very useful and a stock of these with packing materials should be obtained two or more days previous to the show.

Quality alway counts more than size. Produce often has a low value on account of being too large and coarse.

Avoid staging more than the required quantity. For instance, if six (6) tomatoes are required by schedule, do not stage seven because you have seven good ones or for any other reason. If doubtful of quality, exhibit separate samples. Exhibitors can take only one prize in each class, but they may stage three or four samples. Put small fruit and vegetables on plates, with—in the case of fruit at least, a few healthy leaves of the plant to which the exhibit belongs. Always allow plenty of time to stage exhibits by forwarding them early to the show-room.

For the benefit of School Teachers, Cottagers and other growers preparing for forthcoming Vegetable Shows, the following notes have been compiled :

Crop.	No. of days. required for germination.	No. of months required to mature.	Remarks.
Beet ...	6-15	3—4	
Beans ...	4-10	2—4	The time given is approximate in each case.
Cabbages ...	4-12	5—6	
Carrots ...	6-12	3—4	According to quality of soil and care taken with plants time taken will be sooner or later.
Celery ..	6-12	3—4	
Corn ..	4—8	3—4	
Cucumbers ...	4—8	2—3	
Melongénes ...	8-15	5—6	
Kohl-rabi ...	4—6	2—3	
Lettuce ...	3—5	2—3	
Mustard* ...	3—5	1—2	
Okra ...	8-10	2—3	
Onions ...	6-12	6—7	
Parsley ...	8-12	1—2	
Peas ...	5-12	5—6	
Parsnips ...	4—8	2—2½	
Peppers ...	6-15	3-12	
Pumpkin ...	4—8	3—5	
Radish ...	3—5	1—1½	
Tomato ...	4—8	2—4	
Turnips ...	4—6	2—3	

*For Bread-and-butter Salad, use Mustard leaves when only 6 or 10 days old.

647.—ANT DESTROYERS.

Liquid Ant destroyers are now in use in Trinidad under the various names of

1. "Green's Exterminator."
2. "Calypso."
3. "Fuma."
4. "Bachacticide."
5. "Compound Liquid Fumigator."

The active part of these liquids is principally *Carbon-bi-sulphide*, but to some of them, various substances are added which are readily dissolved by the main ingredient. This may be purchased in the United States, and in Europe at a very cheap rate.

It is effectively destructive to all kinds of Ants, Land Crabs, burrowing animals, Cacao borers, Book insects, &c., &c., in fact to animal and insect life of all kinds.

The liquid is generally recommended to be exploded in the holes or burrows, but our experience leads us to conclude that there is a great loss of effectiveness when the material is exploded and that it is better and more effective to apply the liquid on wads of cotton wool, tow, rag, or other material; and cover the holes and allow the gas which the liquid produces to penetrate to all the recesses of the retreats of either insects or animals.

One of the liquids on examination proves to have the following materials added as the residue after evaporation was composed of 62 per cent. of napthalene and 38 per cent. of sulphur These substances readily dissolve in Carbon-bi-sulphide, but it has not been found that they add anything to the effectiveness of Carbon-bi-sulphide used alone.

648.—THRIPS AND BLACK BLIGHT.

The following report by Mr. H. A. Ballou, the Entomologist under the Imperial Department of Agriculture for the West Indies, gives considerable information as to the attacks of Thrips and black blight in Grenada. In Trinidad so far these infections have not been of great importance.

Thrips give considerable trouble in Hot House culture in temperate climates; but are generally very successfully kept down by syringing, and by maintaining an abundance of moist air. To the greater humidity of the climate of Trinidad, is probably due the general freedom from attack which our planters experience.

Barbados,
17th May, 1904.

"Sir,—I have the honour to present herewith a report on my visit to Grenada from May 10th to 13th inclusive.

2. During this visit, my attention was given to an investigation of the "Thrips" of Cacao and "Black Blight."

3. Thrips of Cacao (*Physopus rubrocinctus*).—This pest has been known in Grenada since 1898 when it attracted the attention of the Cacao Planters, and specimens were sent to the British Museum for identification. In November, 1899, Mr. Broadway, Curator of the Botanic Station, sent a letter to this office referring to mention of it in the Report of the Grenada Botanic Station, for 1898 and recording its appearance at Good Hope Estate. Since that time, there have been several outbreaks of this pest in Grenada, and it has also appeared in other islands.

4. The following is a list of the published references to "Thrips" on cacao at Grenada most of which contain also recommendations as to the treatment of the disease or the use of spraying apparatus for applying insecticides:—

(1.) West Indian Bulletin, Vol. II, pp. 176, 181 & 288.

(2.) Agricultural News, Vol. II, pp. 56, 66, 88 and 134; Vol. III, Page 10.

(3.) Grenada Official Gazette: 1898, pp. 121, 198 & 229: 1900, 16th February; 1901, 15th April.

5. On May 12th, I visited Hope Estate where the cacao was reported to be badly attacked by "Thrips." I found that the latest serious attack occurred in November and December, 1903. One field of about two acres was entirely dead, and I was informed that it was due to the attack of thrips. In other fields many trees were dead and others had dead twigs and branches on them and no cause could be seen, but I was told that they had been seriously attacked by thrips. Not many thrips were to be seen in any field at the time of my visit, but a few were present in several different places, and trees were plainly suffering from some cause which I could not find, but I was assured that they had been seriously attacked by thrips during the last general outbreak.

6. At the Botanic Gardens I saw thrips on the leaves and pods of cacao, but not in sufficient numbers to do serious damage, and in driving from Sauteurs to Hope Estate, I saw by the roadside many fields in which the trees showed the leafless, apparently dead, twigs which are said to be the result of the thrips attack.

7. Upon several estates spraying has been employed, rosin wash, rosin compound, Whale-Oil, Soap and Kerosine Emulsion have all been tried and fumigating has also been practised as well. Fumigating is done by means of small bush fires on which sulphur is sprinkled. The amount of sulphur used is some 5 or 6 lbs. per acre. It is impossible that this could have any effect in killing thrips, and is probably merely time and money wasted. Any sulphur fumes strong enough to kill thrips in an orchard would probably seriously injure the leaves and would certainly render the atmosphere absolutely unfit to breathe so that the labourers would be unable to remain in the vicinity of the fires. No experimental spraying has been carried out so that it is impossible to say how much good has been done by the use of any of the washes tried. The spraying was done with different washes in different places and no exact comparison can be made between the different kinds of treatment.

8. I am of opinion that the matter of first importance in connection with the control of this pest is careful experimental work. An area of cacao should be chosen which could be divided into a number of plots, all having the same conditions of soil, drainage, exposure, etc. Each of these plots should receive a particular and definite course of treatment over a considerable period of time. This would furnish more or less definite results, and give an opportunity for judging between the various materials used, and for comparison of treated areas with neighbouring untreated ones. The life history of thrips should be carefully worked out, and an investigation undertaken as to the food plants of the species other than the cacao. I believe that experimental work of this kind is all that the Government can do in the matter. Each estate owner and proprietor will have to make practical application of the knowledge furnished him.

9. Black Blight is a fungus of the genus *Capnodium*. It finds nutriment and favourable conditions for growth in the secretions of the scale insects and is nearly always to be seen in greater or less quantity on scale infested trees. As a first cause of injury is com-

paratively insignificant, the damage done to plants attacked by Black Blight being almost entirely damage by scale insects.

10. Several trees are always to be seen which show the Black Blight on leaves and twigs. The most striking of these are :—

The Clammy Cherry	*Cordia Collocca.*
Mango	*Mangifera Indica.*
Breadfruit	*Artocarpus incisa.*
Sapodilla	*Sapota Achras.*
Guava	*Psidium guava.*
Limes	*Citrus Medica var acida.*
Oranges	*Citrus Aurantium.*

Black Blight also seems able to subsist on the products of several different kinds of scale insects prominent among which are the following :—All the species of the shield scales (*Lecanium*) ; the glassy star scale (*Vinsonia stellifera*) ; the mussel scale (*Mytilaspis citricola*) ; and the mealy shield scale (*Protopulvinaria pyriformis*). Many of the plants affected by these scales, and the attendant black blight, live on year after year though the upper surfaces of all leaves seem to be thickly coated with the mycelium of Capnodium and the under surfaces and small twigs seriously attacked by scale insects.

11. No serious attack of Black Blight, or the scale insects causing it, have yet been observed on cacao or nutmeg and it may be stated as a general truth that, until the scale insects attack these plants, the Black Blight will not, and that any observant planter will be able to detect the beginnings of such attack, and by the application of contact insecticides will be able to ward off the attack before it assumes serious proportions. The fact that for so many years cacao has been grown in these islands where many of these scale insects are native, and cacao has never been seriously attacked by them would lead to the supposition that it is not a favourite food plant for the scales.

12. Mr. MacNeill, Agricultural Instructor, in a letter dated December, 1902, gives a long list of plants affected by black blight and says " When mangos, breadfruit and other trees become affected with the blight, the crops suffer and I have heard of cases where the trees died," but he does not say from his own knowledge that black blight does kill trees, or that he has ever seen trees that he considered had been killed by this pest. As bearing on this point I would refer to the mango. This tree, in many places is affected year after year by the black blight and yet each new crop of leaves comes on and fully recovers the tree so that with the casting of the old leaves and the bursting of the new, the tree stands to all appearances a clean and healthy tree. Many affected leaves are left however, and in a short time the scale insects take possession of the new growth and the black fungus soon appears on the leaves which were clean.

13. When in Grenada, I noticed that the trees in the vicinity of St. George's were much more commonly attacked by black blight than along the leeward coast and in the northern part of the island. What conditions are responsible for this I am not able to say, but I presume that the more unnatural nature of the locality leads to this prevalence.

14. The extermination of Black Blight in an island like Grenada

would be a practical impossibility. That is to say, the expense of exterminating the various scale insects which furnish conditions favourable to the growth of the black blight would entail an enormous expenditure of money, which would hardly be warranted until it gave evidence of being seriously injurious to a valuable crop, and it would necessitate the destruction of so many trees and food plants of the scale insects that the results might be more unfavourable and far-reaching than would be supposed. The control, however, of black blight and the scale insects it follows, is, on the whole, a simple matter on any given area. As an illustration of this point, I might cite a few trees at Chelston and Strathmore, Barbados, which have been sprayed during the past year : —

(*a.*) Lime trees at Chelston. These were badly attacked by the Snow scale (*Chionaspis citri*), and the mussel scale (*Mytilaspis citricola*) and the leaves were covered with black blight. These were sprayed with Lefroy's mixture, August 7, and again August 20, 1903. At this time (May 23, 1904) a few scales are to be seen, and on one branch a few leaves are affected by black blight.

(*b.*) Breadfruit, sprayed with Lefroy's mixture August 20, 1903. For a long time after this spraying, this tree appeared to be free from black blight. For a few weeks past a few leaves have been covered with black blight.

(*c.*) Barbados cherry (*Malpighia sp.*) attacked by *Protopulvinaria pyriformis*. This tree was well covered on leaves and branches by black blight. Sprayed with Lefroy's mixture April 2, 1904. This spraying took off nearly all the black blight, and killed the larger part of the scales. A second spraying was given April 28, and now no black blight is to be seen, and it is only by diligent search that living scales can be found.

(*d.*) Avocado pear, badly attacked by *Protopulvinaria pyriformis* and black blight. Sprayed with Lefroy's mixture twice in April, the second spraying occuring on the 28th. The black blight is practically all off but a few live scales are to be found at this time. One more spraying will probably kill nearly all these.

(*e.*) Mango, badly attacked by the glassy star scale (*Vinsonia stellifera*) and black blight. Sprayed with same mixture as the Pear. Scales practically all killed, (less than 1 per cent. still alive) and black blight all off.

15. These examples should serve to show that the black blight can be controlled, and with very little cost and labour. I am of opinion that if the Government would undertake a certain amount of experimental work, so that estate owners could see the good effects of spraying, and if they would then practise the methods that had been found successful, the black blight would be controlled with a minimum of trouble and expense.

16. In conclusion, I would again point out that black blight is unsightly but comparatively uninjurious; the scale insects which it follows may however become a serious pest, but they can be controlled

H. A. BALLOU."

649.—COCOA PLANTING IN SAMOA.

The introduction of the cocoa-growing industry into Samoa dates from 1883, when 100 trees were procured from Ceylon, and were followed in 1884 by 383 trees obtained from Java. The industry has not yet attained any great magnitude, but there are great expectations of its ultimate success, and much attention is being paid to it. In 1899 the area under cocoa was estimated at 300 acres, planted by foreign residents, and an unknown area on native lands. The Apia Customs Returns show 400*l.* worth of cocoa exported in 1901 and 625*l.* worth in 1902.

In 1903 Prof. F. Wohltmann visited Samoa on behalf of the German Colonial Economic Committee and of the German Trading and Planting Company of the South Sea Islands to investigate the condition of the cocoa planting there, and of other cultivations suited to the Samoan Islands. An account of his visit and recommendations is published as a Supplement to the January number of the "Tropenpflanzer" for 1904, and from it the following points which may be of interest to planters in British Colonies are summarised.

The Samoan Islands, of which the two largest, Upolu and Savaii, belong to Germany, lie only 14° south of the equator, and possess a tropical but very equable climate. The usual range of temperature is from 68° to 88° F., but extremes of 66° to 94° F. have been recorded. Violent winds and thunder-storms are not of frequent occurrence, but severe hurricanes sometimes sweep over the islands, though only in every seven to nine years. The dampness of the air is not so great as would be expected in tropical islands, but it is high enough to meet the requirements of all moisture-loving tropical plants. In the rainy season, which lasts from November to March, the air is usually almost saturated with water vapour. In the dry season, lasting from April to the end of October, the hygrometer shows in the morning and evening about 90 per cent. and over of complete saturation, but at 2 p.m. about 65 to 75 per cent. is observed: this circumstance is very favourable for the drying of cocoa and of copra.

As regards rainfall, the record kept at Apia extends from 1890 onwards, and as evidence of prior conditions it is noted that only once since 1857 has the food supply fallen short and occasioned a famine. The mean annual rainfall for the 13 years, 1890 to 1902, is 115 in., and the extremes in that period are a minimum of 89 in. and a maximum of 163 in. As far as quantity is concerned, this minimum fall is sufficient for cocoa and plants needing much water, but on the Samoan coast the rain is not well distributed in the course of the year, and there are years when periods of drought last too long, and are too intense to suit the needs of the cocoa plant. If for two or three months in succession the fall is only 0·8 in. per month, the yield is very seriously threatened: for this reason suitable localities at higher altitudes should be sought when selecting land for cocoa planting, as the rainfall is heavier in such situations. It must be remembered, however, that at higher altitudes the coast variety of cocoa may not grow so well, and that above 1,600 ft. the plant is likely to fall a victim to parasitic growths and other vegetable enemies.

As the land in Samoa is very variable in its nature, before purchasing a plot, it should be thoroughly tested by digging numerous holes to examine the soil and subsoil. The cocoa tree is deep-rooted

and the most important point consequently is the existence of a considerable depth of suitable soil. The tap root usually penetrates to a depth of 4½ to 6ft., and its course must be unimpeded if the tree is to grow to a height and maintain a thriving condition, and in times of drought a deep tap root enables the tree to draw on the stores of underground moisture. Failure has been observed to happen when the root, after traversing a layer of loam, reached a sandy layer affording only a poor supply of moisture: the disease-resisting power of the tree was diminished, and it fell a victim to a fungus which attacked its bark. The existence of standing water at a depth of 2 ft. has also caused the death of the tree. Soil extending to a depth of 4½ to 6 ft. is the best: the presence of stones is immaterial provided that they do not exceed 50 per cent. of the whole soil, and provided that the tap root does not strike against one of them in its descent; the obstruction caused by a large stone would be fatal. On this account the spot where a tree is to be planted should first be examined with the aid of an iron bar, and any stones likely to interfere with the root should be removed. Healthy trees will live for 35 years and more, and if properly treated will be serviceable for 20 years. If this preliminary testing is omitted the tree may grow luxuriously for four or five years, and then fail owing to the root reaching a sandy layer or striking on a stone. Thus for a safe system of cultivation the preparation of holes for the plants is absolutely necessary.

Owing to the looseness of the Samoan soil, when planting cocoa, either as seed or as young plants, it must be well compressed by treading to prevent any subsequent sinking in of the soil, which would be injurious to the young plants. Holes should be dug about 2 ft. deep, and the subsoil should then be further explored with an iron rod of 1½ in. to 2 in. thickness. In planting out the young trees from the nursery, care must be taken that the tap root is not bent or cracked. But little care has been bestowed on this in Samoa, and thousands of trees can be seen which have suffered in consequence, the roots having been pressed into the planting hole, and the tap root, instead of going straight down, has been bent into a curling shape or at right angles. This has happened when the planting has been left to unskilled natives with inadequate supervision. Plants thus crippled grow well at first, but never make healthy trees or reach full age, and they only yield 40 or 50 per cent. of a full crop.

The choice of seed for planting is of the greatest importance: the pods selected should not be over-ripe, and should not come from too young trees nor from diseased ones. Only seed of the best class and free from every fault should be sown. The best variety of cocoa bean to plant is one descended from the trees imported by the German Trading and Planting Company, in 1883 and 1884; it is always known in Samoa as "Criollo," but is quite unlike the "Criollo" of Trinidad, surpassing it in quality; it is also unlike the "Forastero" cocoa. In fruit, nibs and form of tree it most nearly resembles the cocoa in Guatemala and Colombia; the beans are said to be as good as the best South American, and to fetch at Hamburg 50 per cent. more than the best cocoa from the Cameroons. The pod is of a dark red colour and about 6¾ in. long and 3¼ in. thick; a smaller form of pod is of a bright red colour, with orange furrows, and is 6 in. long and 2¾ in. thick.

As the tree increases in growth pruning is very necessary, and suckers should be removed as soon as possible. When branching has developed and it is possible to see how the young tree is inclined to grow, it should be pruned into a proper shape, and only three or four main branches should be allowed to develop. The best shape for the tree is still a matter of opinion, but in any case it should be prevented from growing too thickly or too high.

Wherever the cocoa is grown in an exposed position, trees to keep off the wind are necessary. For this purpose a strip of the original forest may be left, and is one of the best protections; it must be fairly wide, or it will not last; a width of 45 yards should generally be sufficient, but if the land is available 110 yards may be kept and rubber trees can be planted in this strip. In the Samoan coast lands shade trees are necessary as the dry season often lasts for six months, and is very intense; they are probably advisable, too, at the higher altitudes. Forest trees should never be left standing to act as shade trees, but for this purpose *Albizzia stipulata* may be planted; *A. moluccana** grows more quickly, it is true, but it is too easily broken by the wind, and is apt to grow excessively, requiring a liberal removal of its branches. There should be from 10 to 20 shade trees per acre, but on this point observation should be made in each locality, as no fixed rule can be made to meet the varying conditions of soil and climate. In Trinidad in many places it is the custom to have as many shade trees as cocoa trees, the trees being planted alternately. Quite recently indiarubber trees, especially *Hevea brasiliensis*, have been recommended for affording shade.

The soil of the cocoa fields must always be kept clean, that is, round about the cocoa tree: in Samoa the long, dry season is very opportune for this work, and the expense involved is scarcely a third of that in the Cameroons. Cleaning the land must be seen to from the very first, and it is most important that the jungle should be completely and properly cut down and burnt at the right time, avoiding large and deeply-burnt patches. The stems of large trees can be left to moulder away.

When the ground is cleared the planting can begin, and papaya trees, which will grow nearly everywhere, can be used as the first shade trees. As in the cultivation of fruit trees in Germany, the provision of well-cleaned land and of shade must be seen to for each individual, newly-planted tree. The planter must be on the look out for the attacks both of animals and of disease, and their causes must be discovered; they are often due to excessive shading, deficiency of light or air, or excessive moisture in the soil, and frequently can be easily remedied.

The best methods of fermenting and drying the cocoa, and also the length of time to be allowed for the fermentation process are still undecided questions. The produce of small plantations is most conveniently treated along with that of other planters, and this makes it advisable to have the same variety of cocoa grown by all, as different varieties require different treatment in the final preparation.

The question of manuring is a most important one; it is true that in the higher lands where the burning of the jungle has afforded

* Specimens may be seen at St. Clair Experiment Station.

a rich supply of ashes to the soil, manuring may not be needed at first; but in the lower localities, and especially on those fields which have been used recently by the natives or reclaimed from jungle of no great age, the need for manure requires to be considered. The soils of Samoa are remarkably rich in nitrogen and phosphorus, and the addition of these elements may be set aside as not requiring much attention, but the question of supplying lime and potash to the soil and crop has to be carefully inquired into. Whether their application is necessary or profitable in a given place can only be determined by experiments; the results of soil analyses can only furnish hints as to the manure to be applied. Experiments have already been made by the German Trading and Planting Company, and are again to be undertaken.

The coral sand of the islands, which is abundant and cheap, can be used to supply lime; the wood ashes, too, which can sometimes be obtained, contain about 30 per. cent. of lime, in addition to the more valuable potash. When the cocoa is harvested and prepared, the husks and pulp can be returned to the soil, but the beans are completely removed, so that the potash they contain is lost to the land.

Cocoa beans, like all fruits rich in carbohydrates, are rich also in potash. 100 Samoan cocoa beans were found to weigh 66·4 grams, of which 7·2 grams (10·8 per cent.) were shells and the remaining 59·2 grams (89·2 per cent.) were kernels. The shells contained 5·8 per cent. of ash, in 100 parts of which there were 41·6 parts of potash (K_2O), 8·0 parts of lime (CaO), and 19·8 parts of phosphorus pentoxide (P_2O_5). The kernels contained 2·8 per cent. of ash, in 100 parts of which they were 34·8 parts of potash, 5·2 parts of lime, and 37·5 parts of phosphorus pentoxide. From this it follows that 100 lbs. of cocoa beans contain 0·88 lbs. of potash in the kernels and 0·26 lbs. of potash in the shells, making a total of 1·14 lbs. of potash. Allowing 200 cocoa trees per acre, and assuming that they yielded the exceptionally good harvest of $4\frac{1}{2}$ lbs. per tree, there would be 900 lbs. of beans removed per acre, taking with them $10\frac{1}{4}$ lbs. of potash. This would be the loss if all the husks and refuse were returned to the soil, which, however, does not always happen, and besides this a certain amount of potash is used in producing the annual increase in size of the tree, and is consequently stored away in the wood. This estimate points to about 20 lbs. of potash as the amount that should be supplied per acre in the manure. It could be given by applying about 40 lbs. per acre of commercial potassium chloride manure, costing about 7*l.* 10*s.* at Stassfurt, in Germany, the place of manufacture: in addition to this, the cost of freight would have to be allowed for. If good wood ashes were procurable about 200 lbs. of them would give the requisite 20 lbs. of potash; but if they had been exposed to rain or wet, the valuable potash in them would have been washed out, as it is present in a soluble state.

This manuring may be expected not only to supply food to the tree, but also to improve the physical condition of the soil and increase its power of retaining moisture in dry weather. It should be applied in the dry weather when the weeding of the plantation is undertaken, and should be hoed into the surface of the soil extending to a distance of about 3 feet from the stem all round, and this area

should be covered with a layer of dead weeds to protect the soil from drying. As the upper portion of the tap root is surrounded by a thick web of crown roots, which lie close under the surface, any hoeing must always be done very superficially and with great care to avoid injuring the roots.

It is hoped that the experiments which is now being carried on in Samoa according to Prof. Wohltmann's directions will yield results of great value for the guidance of cocoa planters.— (*Bulletin Imperial Institute—March, 1904.*)

650.—COTTON PLANTING.

In June last His Excellency the Acting Governor authorized the offer of prizes as per following advertisement for the encouragement of Cotton cultivation :—

OFFER OF PRIZES BY THE GOVERNMENT.

His Excellency the acting Governor has directed it to be notified for general information that the following prizes are offered :—

1. For the best two acres of "Sea Island Cotton." grown during the season August, 1904, to March 1st, 1905. 1st—£10, 2nd—£6. 3rd £4.
2. For the best one acre of "Sea Island Cotton." 1st—£5, 2nd—£3. 3rd—£2.
3. For the best sample of ginned "Sea Island Cotton" in bale of not less than 150 lbs. in weight.—A prize of Five Pounds (£5).

All Cotton to be harvested not later than 30th of April, 1905.

Entries for the competition are to be made on or before the 1st of September, 1904, addressed to Superintendent Royal Botanic Gardens, St. Clair.

Sufficient seed will be supplied free of charge to those entering the competition, on application.

Twenty-one competitors have entered the list and have been furnished with seed as per advertisement issued free of charge.

All but one of the competitors are small proprietors, but the one exception has a large area under Cotton, and purchased seed from the department.

Seed is still on hand and can be obtained on application at 2 cents per lb.

The Experiment Plots are now well under way. The *River* Estate plot looking to be in excellent health.

A consignment of nine (9) varieties of selected Cotton seed was received in exchange from the United States Department of Agriculture, Washington.

Samples of these will be grown during the current season at various places, so as to give them a fair trial.

Among these are varieties called long Staple "Upland," and true "Sea Island" Cottons.

The present season will probably determine whether "Sea Island" can be profitably grown in Trinidad. If it is not successful the next best is clearly the "Long Staple Upland," and the present lot of seed will enable planters to judge of its adaptability to our climate.

651.—SEEDLESS LIME.

We are glad to be able to report the successful budding of several plants, from bud wood brought in recently by Mr. F. Evans, Assistant Superintendent.

It is hoped to be able to distribute a certain number of stock plants among Botanic Gardens and Stations early in the coming year.

652.—"CITRUS PONDEROSA."

A fruit under this name was exhibited by Revd. Dr. Morton; the produce of a tree introduced by his son the Revd. H. Morton, at the August meeting of the Trinidad Agricultural Society.

The fruit shown was simply a ponderous edition of a lemon with all its parts increased in size, but it exhibited no special merit, nor did any appear to be claimed for it, other than as a curiosity. It is probably a seminal variety of *Citrus medica*.

653.—THE RED OR CAYENNE GUAVA.

At p. 279 of Vol. IV. of the Bulletin, a figure of the fruit of the above was given. (October, 1900).

Seeds were sown at the time, and plants raised, many of which were distributed to correspondents. Among the recipients was the Revd. Dr. Morton, who is well known for the active interest he has for many years taken in Tropical Agriculture. At the September meeting of the Trinidad Agricultural Society, this gentleman produced a specimen of the fruit grown by him from plants raised in 1900. The specimen was of large size and much admired. It is to be noted that the fruit was produced by trees under four years old, from the time the seed was sown.

It is not known, how the name arose, or whence the original plant was derived.

654.—TOBAGO PINE-APPLES.

Each Island in the West Indies appears to possess fruits showing distinctive characters from adjoining Colonies. That this should be so, is not surprising, seeing that West Indian fruits until the last few years were solely propagated by seed, and it is to be expected that many of the seminal varieties will have proved permanent (?) or fixed in type.

Mr. Millen, the Curator of the Botanic Station, collected the native kinds of Pine Apples in Tobago, and this year sent over ripe fruit of four in order that the Trinidad Department might estimate their value.

The following were the notes made :—

No. 1.—Black Antigua. (*Tobago name.*)

True to name. This variety is also known in England as "Ripley Queen," and there is a lighter leaved variety known as the "White Ripley," bearing fruit of the same class. When in good order there are few Pine-Apples to beat this variety for flavour. The specimen sent was over-ripe.

No. 2.—No Name.

A pine resembling smooth Cayenne by its smooth leaves only. The form of the fruit, and flavour differs. It is much nearer to a variety known in Jamaica as "Black Pine," or "Black Jamaica," but not it. It is a desirable variety.

No. 3.—"Grass Pine." (*Tobago name*).

Resembles very much if not identical with the "Cowboy" of Jamaica "Pens." In the condition it reached Trinidad it is an excellent pine of good flavour.

No. 4.—"Sugar loaf." (*Tobago name*).

Not the Sugar loaf of Jamaica, but more like one called "Bull Head," but better in flavour. A pine well worth growing. It appears to resemble very closely the pine known in Trinidad as the "La Brea" or pitch lake pine, but has not the form of a "Sugar loaf."

Trinidad is not an Island generally suited for the growth of Pine-apples, as the soil is unsuitable, but in certain districts where sandy soil exists, pines may be found by the roadside growing and fruiting well in a wild condition without any care. At the Gardens and Experiment Station it has hitherto been impossible to grow pines with success, while in Jamaica the same operator, was for many years highly successful.

655.—SEEDS: LOSS OF VITALITY.

Residents in cold climates or of the temperate zone often fail to comprehend the failure of certain seeds when sent to the tropics, and the early loss of vitality which ensues. Residents in the tropics know well from dire experience the untrustworthy character of seeds which have been kept for any length of time, and complaint is sometimes made of seeds failing to germinate after they have been sent out fresh by this Department, and after the germinating power of the seeds had been carefully proved by experiment before distribution.

It is well known that there is a great loss of vitality owing to the high temperature, and the action of an atmosphere which for many months of the year remains for a large part of each day, at or near saturation point; but this fully admitted, would hardly account for the loss of vitality of seeds distributed immediately after proof.

For instance, proved cotton seed was distributed and the returns showed a large percentage of failure, while many of the recipients reported the seed as good. It was evident therefore that the want of vitality arose from causes outside of the centre of distribution.

From observations since made, it is evident that *non-vitality* is very often due to the attack of vegetable feeding ants, which are specially fond of oily or sugary seeds, those seeds containing oil or sugar suffer in proportion to the amount of these substances they contain.

One of the worst of these enemies is a tiny ant, known locally as the "Sugar Ant," but whose scientific appellation has not as yet been determined.

These ants commence work by attacking the point of growth in the seed, and eating away the whole of the germinal parts or embryo, which act is sometime effected without in anyway altering the outward appearance of the seed and unsuspecting cultivators would be led to consider the seed as fresh and good, unless a close examination is carried out.

On learning of the pernicious attacks made by these small creatures, measures should be adopted to store all seeds in spaces protected by water channels, and by doing so it will be found that the percentage of seeds germinating will be largely increased.

In consequence of the difficulties attending storage, it has been found necessary to adopt the practice of sowing or sending away all seeds as soon as ripe, and never keeping them on hand for any length of time.

656.—VARIATION IN COTTON SEEDS.

From samples of Cotton seed received by the Department at different times, it is apparent that there is either real variation, or that, Cotton seed is very variable in appearance.

American literature speaks of Cotton as a variable plant: and considerable trouble is taken to perpetuate the new strains which are raised by seed selection.

The difference between seed of the "Upland" and "Sea Island" varieties is well marked by fuzzy or woolly appearance of "Upland" and the clean appearance of "Sea Island."

A sample of the latter, received from the United States Department of Agriculture, contained not a few woolly seeds. Whether these are due to variation, or to imperfect maturity cannot be at once determined; but it is clear that if picked out and grown, the vegetative characters must reveal their affinity in due course. An experiment has therefore been started at St. Clair, which we trust will end in clearing up the point.

657.—FRESH WATER ALGÆ AND WATER CONTAMINATION.—"*Not so bad as painted.*"

The various species of vegetable organisms classed under the head of *Algæ*, afford some of the most beautiful objects known to microscopists. Some species are found in fresh and others in salt water, others are found on wet rocks, in mosses and on the trunks

of trees, gate posts, and various other situations suitable to their existence. Some of the species were formerly thought to belong to the animal Kingdom owing to their possession of the power of movement, but their position as vegetables is now too well defined to admit of further controversy.

These plants are devoid of roots, and they are determined principally by the form of the cells of which they are composed. Some species live in social relationship with Fungi under the name of Lichens and also with some of the lower forms of animal life. Kerner and Oliver p. 113 Vol. I. state that, "Saprophytic marine and fresh-water algæ are able to absorb the products of decay in the water around by means of a superficial layer of cells."

The *Desmidiaceæ* and some of the various filamentous algæ accumulate secretions of calcareous matter, and the *Diatomaceæ* secrete silicious material in building up their cells.

Algæ abound in the Arctic as well as in temperate and tropical climates, and are most commonly found in still pools or slow moving waters: but some species are to be found in rapid running streams and even in waterfalls.

The green scum or slime which appears in reservoirs, and aqueducts, is chiefly composed of these organisms, and the presence of such material is often thought by the superficial observer to show contamination: but as a matter of fact *the great majority of the species will not exist in contaminated water*, and are readily killed by the addition of minute quantities of Ammonia or Copper in liquid form.

Instead therefore of being direct evidence of contamination, Algæ afford strong evidence that the water in which they grow is uncontaminated.

The Diatomaceæ are found in both salt and fresh water, while the Desmidiaceæ are only found in fresh water, and a large number of species are to be found in Trinidad waters. Wolle in his work on the Desmids says: "We are under no small obligation to them for aiding to keep the atmosphere in a wholesome condition since they absorb carbonic acid largely, and exhale large quantities of oxygen."

Some species under cultivation in the Botanical Laboratory at St. Clair, prove very clearly that Wolle's statement is correct, for not only can the bubbles of oxygen gas be seen to develop and rise to the surface but it also becomes apparent how these plants actually make use of the gas bubbles to effect contact with the air, as the organisms are gradually brought to the surface by aid of the rising bubbles. Observations have shown that large numbers of these plants rise to the surface during daylight and again descend to the bottom during the night hours. Indeed they form an excellent lecture room example of the evolution and dispersion of oxygen. They can be made to evolve oxygen much more freely, if a small quantity of acid is added to the water in which they are growing.

Algæ are generally present in waters as mixed communities of species; and in our present collection some ten or twelve species have been noted, among which the *genus* Cosmarium is the most numerous; in company with one or two filamentous forms, and a few of the smaller species of Diatomaceæ.

While examining specimens in the living state recently, an organism known as a Rotifer, a member of the animal kingdom, was seen actually engaged in devouring cells of the Cosmarium. As these small animals are practically transparent, the process of digestion can be seen going on inside the body of the animal, and the Cosmarium after being swallowed was easily distinguished.

Some of our friends may say: but if water contains animal organisms, it cannot be fit for consumption. That of course, is but a natural conclusion: but if they were asked to condemn water because a small fish was seen to be swimming in it, they would hesitate to do so. Yet the fish would probably be the agency for contamination, a million times greater than would the Rotifer.

Fish must be admitted to contaminate water, but at the same time the degree of purification they perform by feeding upon more objectionable organisms, more than negatives the amount of contamination they actually occasion. Now, the fish eats the Rotifer, the rotifer eats the Algæ, and by this means the balance of nature is preserved, and it is only when such balance is upset by one or any of the chain of organisms engaged, that humanity suffers by the water becoming contaminated to a pernicious degree.

It is certain that neither the fish, the rotifer or the Algæ can exist in largely contaminated water, and while the balance of nature is fairly preserved and none of the agents at work, are present in excessive numbers, their harmless character should not be doubted.

It is patent, however, on the other hand that Algæ *can* really become the primary means of water contamination: and evidence of this is afforded by recent observations. A quantity of the green matter from the sides and bottom of a reservoir was secured. The latter was found to be chiefly composed of various species of Diatoms, while the sides afforded specimens of a filmentous Algæ known as *Spyrogyra*, as well as a few species of the Diatomaceæ comparing with those found on the bottom. When these samples were first brought in the water was tested, and found to be practically free from ammoniacal contamination, but making a home among the Algæ were found numerous forms of micro-animals, which were soon killed by the weight of the accumulated material, and when the water was tested twenty-four hours afterwards, it was found to be largely contaminated. Therefore, although the Algæ was the primary means, still in reality it was the dead members of the animal kingdom which in this case caused the real contamination and it was the scraping out and placing together in masses, which caused the contamination. In clearing a reservoir, however, such a mass is not allowed to remain in contact with water.

Again it is known that some few species of Algæ do communicate to water certain objectionable tastes; and it is quite clear also that Algæ in a decayed state will become as great a source of contamination, as would indeed any other kind of vegetable matter in a state of decay: but in themselves, and when in a healthy growing state, and in moderate numbers, they are certainly not to be feared. Those that cause objectionable tastes should certainly be at once removed, but it is seldom that such species appear, the harmless kinds being much more in evidence.

It has moreover been found that the presence of a layer of some

of the harmless species on the surface of a filter bed largely increases the efficiency of the filter; and some authorities go so far as to say that no filter-bed can be perfect without them, but in this instance also it is known that when this layer becomes too full of miscrocopic animal life, it must be removed or the supply of water will not be of standard quality.

The Algæ that are known to take up calcareous matter from water are fairly prominent in Trinidad, and specimens of these can be readily seen. The Diatomaceæ which take up silica, when boiled in Nitric acid and deprived of organic matter exhibit the most beautiful markings when seen under a compound microscope, and the writer has found numerous rare specimens in the salt and fresh waters of Trinidad.

The species of Algæ which accumulate calcareous matter, will render the water softer, and better fit for domestic use, by ridding it of excess of lime.

It is to be seen therefore, that while objectionable *Algæ* or green slime clearly exists; there are at the same time numerous harmless forms, and that some of the latter are actually beneficial, and that it is necessary to discriminate between them and not to condemn all on account of the few objectionable members.

Such discrimination is possible, and can easily be made by those conversant with the Hygienic principles which should govern and control the water supplies of large towns.

Our examination appears to lead to the conclusion, that the presence of Algæ or "green slime" in water supplies should not be too hastily condemned, and that those who do so should be asked to explain which species, if any, is harmful. In general, public discussions on such matters are delightfully vague: it being a much easier matter to condemn on suspicion, than to define what is, or is not, the actual cause of contamination in a water supply, and in many cases the cleverest analysts report in terms of suspicion only, without a definition of the actual cause.

658.—THE BUDDING OF ORANGES.

In several cases application have been made to the Department for instruction in the budding of Oranges. When the Instructor has appeared on the spot it has been found that no material was available for the purpose, and the demonstration has had to be postponed.

For the information of those desirous of producing budded oranges or other citrus fruits, it is necessary that the following preparations should be made.

1st. Procure Seville or sour orange seeds, taken from ripe fruit: and sow in rows 18 inches apart in beds in the open ground, thinning the plants, when the seeds have germinated, so as to have them stand 9-12 inches apart in the row. Allow the plants to grow until the stems are about the thickness of a lead pencil, and from 18 inches, to two feet in height: when they will be fit for budding.

2nd. Select orange trees which are known to have produced sweet fruit of good quality, from which to obtain "Bud wood." The "Bud wood" should be taken from partially ripened shoots on which the leaves are seen to be fully developed. These shoots should not be cut until shortly before the operation is to be carried out; as withered shoots, or shoots on which the leaves are withered, are seldom of any value.

The operation of budding is best learned from practical demonstrations; and Instructors will be delegated for service on application, to carry out the process on the spot.

In cases where a quantity of material has been provided the services of a trained employee may be obtained on application to the Superintendent, the wages and travelling expenses of this workman must be arranged for previous to his visit to the estate. The rate will be 50 cents per day, travelling and accommodation extra. In most cases it will not be necessary for the workman to stay for more than two or three days; as the operation is easily learned by any intelligent labourer.

Budding tape will be provided in the first instance by the workman sent, but the method of preparation is republished below for the information of those who are desirous of preparing it for themselves.

Demonstrations of the method employed are given at the Experiment Station, St. Clair, free of charge, to any applicant who wishes to learn the process, and persons wishing to attend, may visit the Station at any time during working hours for this purpose. Three days notice should be given to Superintendent.

GRAFTING OR BUDDING TAPE.

The following is a simple and successful method of making, grafting, or budding tape:—

Materials:—(1) White Cotton Tape, $\frac{1}{2}$ inch wide:
(2) Beeswax
(3) Ship's Pitch
} equal parts.

Directions:—Put equal parts ($\frac{1}{2}$ lb. of each is sufficient for about 15 yards of tape) of beeswax and ships' pitch in a small metal or eathenware vessel with a wide mouth, and heat over a fire, stirring as the two constituents melt together. Then plunge a piece of tape of convenient length into the liquid, keeping hold of one end with finger and thumb. With the other hand hold two small pieces of wood on each side of the outer end of the tape, just in front where it is held by finger and thumb. Then pull the tape through between the two pieces of wood so as to remove extra wax and distribute it evenly over the tape. As each piece is dipped, it should be hung on a wire to dry. It will be cool and ready for use in a few minutes.

Note.—*The black tape used by Electrical Engineers for covering wires is a useful substitute for the above. As it is packed in air-tight tins, it can be kept in good condition for lengthy periods.*

659.—DISEASE IN IMMORTEL'S (Cacao shade).

For sometime past complaints have been received of the dying out of the Cacao shade in certain districts. The tree most affected is *Erythrina umbrosa* or the "Anauca" of planters.

Steps have been taken to investigate the cause of the attack, and specimens have been carefully examined. It has been found that microscopic fungi are particularly abundant, but whether these are of a saprophytic or parasitic character has yet to be seen. The trees attacked, to all appearance are in ordinary health, when suddenly the leaves wither and the bark commences to rot and drop off leaving a bare and barkless stem, which gives off a powerful carrion like odour. In the decayed wood and bark are numbers of wood boring *Coleoptera* and also numbers of *Diptera* in the larval stage.

A similar complaint has since come in from another district, which also demands attention. As far as the investigation has gone the evidence appears to show, that this species of tree is unsuited to the condition of soil and situation of the estate in question, but this must be taken merely as a provisional opinion waiting on further evidence.

TRINIDAD. No. 45.

BOTANICAL DEPARTMENT.

BULLETIN

OF

Miscellaneous Information.

(QUARTERLY.)

JANUARY, 1905.

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Edited by the Supt. Botanical Department:

J. H. HART, F.L.S.

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1905.

660.—CATTLE FEEDING AS A SUGAR FACTORY ADJUNCT.

THE common belief in the western states of the Union is that the distillation of spirits from corn cannot be carried on profitably without the utilization of the by-products of the distilleries in cattle and hog feeding. This conclusion of the owners of distilleries has been commonly accepted for more than half a century and within another half a century we believe that throughout the world, wherever sugar is made from cane or beets, that in a like manner stock feeding with the by-products of the sugar industry will be considered an essential accessory of the industry.

The *Agricultural Gazette* of New South Wales, in its issue of September 2, has gone into an elaborate consideration of the whole subject matter of the relation of the sugar beet to stock feeding and examined into the methods in this country and in Europe and finds that the value of beet pulp as stock feed is really one of the leading foundations of the present beet sugar industry in Europe and is rapidly becoming so in America. New South Wales produces more or less sugar from cane, but has been experimenting in the production of the sugar beet because of its somewhat rigorous climate, which frequently injures sugar cane and from such climatic injury the sugar beet would be comparatively exempt. Vast areas of land suitable to beet culture can readily be had in Australia and as it is a great stock growing country anyway, the leading agriculturists are looking to the combination of these two industries as probably working out in that distant land a quiet, but momentous industrial revolution.

We, here in Louisiana, with our great natural resources, have been wasteful of many of them, concentrating our attention only on the central products and letting by-products go their way, by abandonment, by gift or for sale at some slight price. Within a quarter of a century rice bran in some of our country mills was an unsaleable product and had to be given away in order to get it out of the mills. The common belief was that it was practically worthless as stock food and only after the organization of our own sugar experiment station and the careful analysis of rice bran by Dr. Stubbs and his able assistants and the determination of its great value as a feed stuff, did it begin to acquire that high status that it has since maintained and which is now recognized in this country and abroad, creating a demand for it greater than the supply.

It is about forty-five years ago that the elder Maginnis began the extraction of oil from cotton seed in New Orleans. At about the same time the Union Oil Company, of Providence, R. I., experimented on some cotton seed sent to them. This was the beginning of the great cotton seed oil industry, which has given a value of from one-half to three-fourths of a cent per pound to the cotton seed of the United States, and the quantity of such seed in weight is 2 1-3 times greater than the weight of the cotton crop.

In like manner, the value of molasses as a food stuff has only come to our full knowledge recently. Twenty-two years ago the editor

of this journal began feeding molasses to mules on his Belair plantation on the lower coast, and has continued this practice ever since. While he was the pioneer in the use of molasses for mule feed on the sugar plantations of Louisiana, we find even twenty years later the inquiry was made in a public meeting of the Louisiana sugar planters in New Orleans of the planters there present, "Who among us is using molasses?" and it was found that even then, Dr. Stubbs at the Experiment Station and Mr. Dymond at Belair were the only two there present who were then regularly and methodically using molasses.

It is the adverse conditions that have surrounded the Louisiana sugar industry during the last ten years, beginning with the adverse legislation in 1894, the great snow and freeze of 1895, the low density of the juice and the unprofitable results of the cane crop of 1898, the unprecedented freeze of 1899 and our slow recovery from all of these closely connected disasters, that has really brought our planters face to face with the necessity for every possible economy, and among these stood prominently the value of molasses as a food stuff on our plantations and its extraordinary neglect until the misfortunes of the planters drove them into an appreciation of its full value. Hundreds of thousands of dollars are now annually saved to the sugar planters of Louisiana by their using their molasses on their plantations for stock feed and every year this use is becoming better and better adjusted along scientific lines and the condition of the Louisiana stock on the plantations verifies the judicious use that is made of this great staple.

We find that the distillers of spirits are extremely careful of their by-product, utilizing it in feeding live stock. We find that the beet sugar factories of Europe consider beet pulp as one of the very valuable factors connected with their industry and beet pulp is sought now in the vicinity of all the sugar factories as a staple stock food. We generally have more molasses than we can use successfully on our plantations. Pound for pound, it has as great a feeding value as corn, and yet, it cannot be sold in our markets at prices commensurate with such value and the only way that such prices can be obtained, so far as we can now judge, will be in the fattening of live stock. This, of course, leads to a consideration of the whole live stock question and as to whether our great sugar factories should become breeders and growers of cattle, or simply cattle feeders, as our great cotton seed oil factories utilize a considerable amount of cotton seed meal in fattening cattle for short terms and until they are brought into the best possible conditions that can be had with such food. We have the molasses and can probably grow sufficient crops of alfalfa on our lands as a supplementary nitrogenous food and we know that we can grow an unlimited amount of cow pease, the vines of which are nitrogenous, and these foods, with our native grasses, would seem to give us an ideal stock feeding country. As to whether or not our semi-tropical climate is a good country for the cattle feeding industry, or cattle growing industry, our sugar planters, as a class, are probably unable to say, as for generations their efforts have all been concentrated upon the production of sugar cane and its manufacture into sugar. However, the time has come when it will be essential for us to utilize all of our by-products to the best advantage, and the one wherein we are now realizing to the least advantage is that of molasses.—*Louisiana Planter.*

661. THE GOAT. (*Capra hircus.*)

In commencing a paper on the "Goat," it would be impossible for the writer to follow the essayist on the frogs of Ireland and say "there are no goats in Trinidad."

There are in my opinion, far too many! Perhaps the writer is prejudiced against them personally, and it must be confessed that he has never had any love for them.

He has formed the opinion that the goat is an insiduous and dangerous enemy of the Agriculturist. It requires however the most careful observation to enable one to become acquainted with all the tricks and performances of the goat. To the many, the goat is a harmless animal, and useful to the poor man. Is he? Yes! the animals may be useful for a time, so long as they afford milk, and as long as they are kept within bounds. In this latter sentence lies the *Crux* of the matter, for unless the goat is *kept within bounds*, it is an animal most destructive to vegetation and one which becomes an intolerable nuisance.

Given, a clump of wild bush, near a village; this if left to itself or rather to nature, would naturally soon produce some good timber trees, but the goat having access, carefully searches out for the tips or growing branches of the young trees and nibbles them so continuously that they become stunted, grow slowly, and eventually succumb to its attack. Show us the man who keeps goats! and it becomes easy to point to the man who always happens upon unfortunate incidents in planting a fruit orchard, or a vegetable garden.

The goat should have been tied! it was, and nobody knows how it got loose. Result, a fine young orange tree has been damaged—a valuable young mango tree has lost two years' growth—a sweet Rose bush has been cleared of all its leaves—the potato row is trampled beyond redemption, and the favourite vine cut off just above the root! Such occurrences are not conducive to good temper, and so serious a matter is it in some cases that more than one divorce suit has arisen through the differences caused in families by the presence of goats. Goats and poverty are usually found together. Take any West Indian Colony or district, and if it maintains a large stock of goats, that Colony or district may be written down as poverty-stricken. That the goat is the cause of the poverty would appear from the fact that previous to the introduction of this animal it was prosperous. The Island of St. Helena is a country which may be said to be really goat-stricken, and its native flora has nearly disappeared in consequence. If we read Biblical history we find the goat in the wilderness and no wonder that it was a wilderness so long as the goat was there. We find the goat used for burnt offerings, and if everyone was of the same opinion as the writer, a similar fate would be the best thing that could happen to all the goat family to-day—and the best use to which they could be put. It is not only what the animals eat, but what they spoil, and what they destroy. Many people defend the goat owing to the fact that its destructive character has not been made apparent, to them: but if they carefully watch the habits of these animals they will, if they understand plant-life even a little, be at once led to concede the destructive character of this animal. It has actually become a widely believed story among goat haters that its

bite is highly poisonous and that no tree once bitten by a goat ever thrives. The writer is not prepared to follow this assertion in its fullest sense but, it might as well be true, for a similar result ensues from frequent bitings, as if the first bite were poisonous.

Many people believe that a goat or goats should be kept in pastures with herds of other cattle. This conception has its origin in reasoned out points, but even these require to be further authenticated before they can be received as fact. It is said, *the presence of the goat keeps other animals healthy*. And this is said to be due to the fact that the goat is immune to many poisonous plants, and by the eating of these, prevents cows and other animals from being poisoned. It may be advanced that they afford a good supply of wholesome meat. It is not denied that the meat may be wholesome, but the fact of their feeding on poisonous plants as above stated renders it somewhat doubtful whether the meat can really be as wholesome as it is taken to be. However if it is admitted to be wholesome its flavour cannot be highly praised except perhaps by those whose taste has not been very highly educated. Goat mutton is but the merest apology for sheep mutton. It is at best but a poor substitute, would hardly be acceptable except under the pressure of hunger (especially if the animal has seen years) and could only be eaten with considerable reluctance by *the greater number of* consumers. The most that the writer can admit in favour of the goat, is that it *may* be useful if kept in bounds, but if allowed to roam at will, (as they do in most places,) the animal, instead of being useful becomes a veritable curse to any community by the enormous destruction seen —and unseen—it causes to plant-life.

No orchard thrives where goats abound and no garden can possibly be kept in order, where goats have promiscuous or accidental access, and agriculturists who allow them to remain on Estates to roam at will, will never escape blame for the exhibitions of temper, which is the inevitable result of their presence. If the writer has formed a wrong opinion in the matter there will doubtless be found some who will put him right for expressing it, and ready with a brief in defence of *Capricornis*.

It would be right to hear such advocates and hear what reasons can be advanced that will stand the test of examination, in defence of one of the most destructive and pernicious animals which exist upon the face of the globe.

A strong point in evidence of their destructive propensities is shown by the use made of them in Trinidad for clearing forest land. Where this has to be done goats are purchased by the planter in quantity and kept by a goat-herd on the land which is to come under cultivation. The result is that every small plant is shortly disposed of, and the amount paid for labour in clearing is very considerably reduced. This it will be said: tells as much for the goat as against it: but its destructive character is certainly fully proved by the clearance of vegetation they effect in a short time, and makes it certain that if the goat is to be kept at all, it must be kept "within bounds" and not allowed to roam.

662. CRYSTAL PALACE EXHIBITION.

An Exhibition of Colonial and Indian produce will be held at the Crystal Palace in the summer of 1905.

The Legislature of Trinidad has voted the sum of £1,500 to be devoted to this purpose, and His Excellency Sir Henry Moore Jackson, K.C.M.G., has appointed the following Committee to deal with the matter :—

Hon'ble E. Cipriani.
,, W. C L. Dyett.
,, G. Goodwille.
The Rev. Dr. Morton.
Professor Carmody, F.I.C., &c., &c.
Mr. H. Hoffmann.
,, E. Tripp.
,, J. H. Hart.

Professor Carmody has been elected Chairman of the Committee and Mr. J. H. Hart, Secretary.

A space of 1,500 square feet has been applied for.

Intending exhibitors are invited to communicate with the Secretary at an early date.

663.—PANAX MOROTOTONI.—*Aublet.*

This tree is a familiar one in many parts of the Island of Trinidad, and grows in thickets of forest lands. Enquiries have lately been made for the wood of this tree, on account of the reputed suitability of its wood for the manufacture of matches.

664.—DIPLODIA CACAOICOLA.—*P. Henn.*

This name has been given to a destructive fungus which attacks the pods of Theobroma Cacao and destroys them. It was found some years since in some of the Windward Islands, but to recent date, it had not actually been detected in Trinidad. A few weeks since, however, a pod was sent to this office infected with a fungus which on reference to authority has been provisionally determined as *Diplodia cacaoicola*. So far, however, the disease has not appeared to be prevalent or likely to do any considerable amount of damage; but it will be wise to take steps to prevent its spread wherever it appears.

The measures laid down in various papers for the control of the commoner *Phytophthora omnivora* are also effective for this disease (viz.), the collecting and destroying of all diseased pods, and the burying or burning of the empty "shells" when the beans are extracted. This process of control is I am pleased to record now being carried out on many of the best Trinidad estates with successful results. In one case a prominent planter who has adopted it for some time past has stated it to be highly successful, and that it has resulted in saving a very large proportion of his crop for 1904.

665—ESSENTIAL OIL FROM THE "KING ORANGE" AND FROM UNONA DISCOLOR.

The "King" orange is a fruit imported several years ago from Florida, and is now growing and fruiting at the Experiment Station, St. Clair. The fruit belong to the type of *Citrus nobilis* or "Tangerine" class. It has a dark green skin while immature, changing but slightly to yellow when fully ripe. The pulp of the fruit has a fine flavour, and is bright vermillion in colour. The skin is thicker than is usual with the Tangerine class of fruit, and the oil cells are larger and more prominent in appearance. It bears freely and regularly, and the tree has a peculiarly erect habit distinguishing it at once from commoner kinds.

Recently, a fine clear light essential oil has been extracted from the skin or rind of nearly mature fruits by aqueous distillation. This shows a specific gravity of 0·834. While the ordinary Tangerine yields an oil showing 0·856 specific gravity. The yield in comparison with other citrus oils is nearly double from the same weight of material. The oil has a fine sweet odour, but we have yet to learn from experts how it will rank with others of its class.

Another oil has recently been extracted from the fruit and flowers of *Unona discolor*. The oil from the flowers is heavier and darker than that of the fruit and possesses a stronger odour. It partakes apparently of the character of the oil obtained from *Artabotrys odoratissima*, and belongs to the same order of plants namely, the *Anonaceæ*.

666.—COTTON "BOLL ROT."

The growth of cotton plots has on the whole been very satisfactory so far as growth is concerned, but on some of the fields "Boll rot" is present to a considerable extent.

Of this disease the Bulletin of the Imperial Department of Agriculture says :—

"Boll Rot."—This disease which is due to a bacillus, is far more serious than those mentioned, although up to the present only one or two cases of it have been noticed in the West Indies. The rot starts in the inner tissues of the boll near the point of attachment of this to the stalk. All the tissues at this point, including the cotton and the young seeds begin to decay, and are transformed into a slimy mass. The decay gradually spreads through these tissues and finally involves the whole of the inside of the boll. It is not till this happens that one notices the disease from the outside, as the rot now begins to spread to the walls of the fruit and these begin to present an unhealthy appearance."

That the disease has affected plots in Trinidad now appears certain, as some of the bolls from the experiment plots have been carefully examined and the central rot found in bolls only half grown, the outside of which presented a healthy appearance, but on cutting through the centre both the cotton and the young seeds were seen to be affected.

Subsequent microscopical examination has since proved the presence of large numbers of *Bacteria* in the infected parts of the fruit, and when the matter from the boll is coloured with "Neèlson's" stain, the presence of these organisms is clearly shown by a high power immersion lens.

The attack is not found on one plot only as several instances of the presence of this disease has been discovered in districts widely apart. On the other hand, there are plots sown with the same seed, which, to the present, have shown but little, if any signs of the disease.

At the present time the outlook for the cotton plots is unfavourable, but it is considered possible that with drier weather the effect of the disease will not be so fully apparent.

So far as the vegetation of cotton goes in Trinidad, the growth and progress of the plants is all that could be wished up to the stage when the bolls begin to swell, and it is only then that the disease can be found on examination by cutting through the bolls, still in some places even close to infected fields cotton is to be found which is apparently free from attack.

This disease is found to attack Upland, Brazilian and Sea Island varieties, and all suffer alike on the same fields.

It is not easy under such conditions to prescribe what should be done, and as from published accounts little is known as to an effective treatment, it is fairly clear that cotton cannot be profitably grown in fields where "Boll rot" prevails.

It is no new, or newly imported disease, and has not come in with imported seed, as it has been observed for some years past—and in the Southern States of America, it has been very destructive for years without a remedy being found other than that of giving up the cultivation of cotton at least for a time on the lands where it appears.*

667.—THE BAROMETER IN TRINIDAD.

"While the sun heats the moist air, and makes it ascend, the aqueous vapour acquires an expansive force, which produces a rise in the Barometer until about 10 in the morning. When this action continues the superfluous air and vapour flow off in the higher regions, and the barometer falls *nil* about 3 p.m. when it begins to rise by the momentum of the denser descending vapour. This effect is again diminished after 9 p.m. until a second minimum reached about 4 p.m." —*Cruger, p. 17, Scientific Association, Proed.*

668.—THE LOVE VINE. *Cuscuta sp.*

The Agricultural Protection Ordinance, No. 20 of 1902, was made with the view to control Diseases of plants, and Destructive Vegetable growths.

The Ordinance came into operation on 2nd April, 1904. "Love Vine" or *Cuscuta* was proclaimed a "destructive vegetable growth." 5th March, 1904.

* There is some evidence that the disease is due to imperfect fertilization.

In the following districts officers have been appointed as Inspectors. Toco, Savana Grande, Cedros and San Fernando.

The following notice has been approved under the Ordinance :—

The Agricultural Protection Ordinance, 1902 (20—1902).

*To*_____

Owner / Occupier } *(as the case may be) of**_____

(* *Describe land or buildings.*)

I do hereby direct you within twenty-one days after the receipt of this Order to destroy by burning or burying the same, all of that destructive vegetable growth known as Cuscuta or Love Vine now being and growing upon the said land (or building).

Chief Inspector.

Date_____

NOTICE.—For the disobedience of order—entry may be taken by order of Stipendiary Justice of the Peace at the expense of defaulter, or defaulter may be proceeded against, for disobeying order, and fined a sum not exceeding £20.

669.—PLANTING DISTANCES FOR CACAO AND OTHER CROPS.

The following table will be found useful as a reference for planting distances of Cacao, Oranges, Cotton, Coconuts, &c. :—

Table for planters, showing the number of trees required per acre, from 1 to 30 feet distance between each plant.

Distance feet.	*Number Trees per acre.*
1	43,560
1½	19,360
2	10,890
2½	6,970
3	4,840
3½	3,556
4	2,722
4½	2,151
5	1,742
5½	1,440
6	1,210
6½	1,031
7	889
7½	774
8	680
8½	603
9	537
9½	482
10	435
10½	395
11	360
11½	329
12	302
12½	270

Table for planters, showing the number of trees required per acre, from 1 to 30 feet distance between each plant.—*Continued.*

Distance feet.	*Number Trees per acre.*
13	257
13½	239
14	222
14½	207
15	193
15½	181
16	170
16½	164
17	150
17½	142
18	134
18½	127
19	120
19½	114
20	108
22	90
24	75
26	64
28	55
30	48

670.—NATIVE METHOD OF CACAO PREPARATION.

MAKING CHOCOLATE.

The word chocolate is to be understood as material manufactured from Cacao beans roasted, ground; and hardened into cakes, balls or rolls; which may be used for making breakfast chocolate.

A recent trial of a weight of 24 lbs. of first class Cacao resulted as follows:—

	lbs.	oz.
Cacao in bean operated upon	...24	0
1st.—Loss of weight during roasting and taking off skin of beans was ...19·27%.		
2nd.—Loss during grinding operations ... 6·77%.		
3rd.—Loss while pressing into rolls ... 1·04%.		
27·08%.=	6	8
Total weight of chocolate made ...	17	1

showing loss of over 25% during operation on weight of raw material.

The loss would of course be less in proportion with a larger amount of material.

Makers add variable quantities of sugar, in some well known brands as much as 60 per cent. of fine sugar is added to cake or roll chocolate, so that 40 lbs. of roll chocolate would become 100 lbs. of the sweetened material. It is an admitted fact, that the sweetened material sells much better than the pure product of the Cacao bean.

671.—THEOBROMA ANGUSTIFOLIA—(*Moc & Sesse.*)

This species of Cacao is one of those introduced by the writer from Nicaragua in 1893.

It has given several pods containing mature seeds during the present month November, 1904, so that it has taken eleven years to reach its fruiting stage.

It proves to be a hardy tree in Trinidad and quite distinct from the ordinary commercial Cacao which is the produce of *Theobroma Cacao, Linn.*

The produce of this tree is of no value for making commercial Cacao, as the beans have a strong and unpleasant flavour, and is therefore at present little more than a botanical curiosity. It may, however, prove of value as a stock for the grafting or budding of the commercial kinds.

672.—THE COCONUT BEETLE. *Rhyncophorus palmarum, Linn.*

As the area under Coconut cultivation increases complaints of the attack of the Palm beetle *Rhyncophorus palmarum* have become numerous, and recently several pertinent enquiries have come to hand for remedial measures.

This beetle is known to attack many kinds of the palms, but is more commonly said to be attracted by the "Gru-gru" (*Acrocomia lasiospatha*) the larvæ of this species being commonly known as the "Gru-gru" worm.

It has been found impossible in most cases to save trees once badly attacked, owing to impracticability of getting at the worms so effectually as to be able to destroy them, and hence attention has been devoted to measures which are efficient, although only preventitive in character.

The Life-history of the beetle is well-known, and the habits of the mature insects fortunately afford the planter an opportunity to decrease them in number.

It is known that the beetle lays its eggs in wounds made in the stems, leaf-stalks or terminal growth of a palm tree: whether the Coconut or any commoner species. If, therefore, the commoner species are present as they usually are, it is true economy that they should be sacrificed for the benefit of the more valuable. If the "Palmiste" or "Royal Palm," the "Gru-gru," etc., are present two or three should be selected to be cut down and used for the purpose of attracting the beetles, to enable the operator to catch and destroy them. The mode of procedure is as follows: Cut down "Royal Palm," "Palmiste" or "Gru-gru" or any other palm the beetle is known to attack, and make it into lengths of four to six feet, splitting some of these sections in halves.

Allow these to lie in the open exposed to the weather to allow the pulpy interior to become sour. After the first twenty-four hours, it will be found that fermentation of the sap has set in, causing a sour smell. This odour attracts the coconut beetles which find the sour

wood a suitable place for laying their eggs which are deposited in the crannies or unequalities of the exposed cut-surfaces.

The beetles will assemble in large numbers for this purpose when they can be readily caught and destroyed.

While the beetles are visiting the cut tree, a watch should be set for the purpose of catching them as they arrive during the day, and the place should be visited several times during the night for the same purpose.

If the egg is not laid, no larvæ will hatch, and no mature beetles will be produced, and the egg clearly cannot be laid if the mature insects are destroyed as soon as they come to the point of attraction.

Few persons would believe unless they see for themselves what a large quantity of beetles will appear, and if a careful watch is set over a cut tree, the numbers that will be caught will most assuredly lessen the danger of attack on a coconut plantation.

If it is found that some beetles, escaping detection, have deposited their eggs, they may be allowed to grow in the woody material for a time, but should be destroyed before they arrive at the chrysalis stage.

By following the method described it is certain that the attack of beetles can be well kept in check on coconut plantations.

If it is found that a coconut tree is badly attacked, this itself should be at once cut and used as the attraction; as it is seldom a tree once attacked will recover sufficiently to be profitable, and it is clearly better to cut away the tree and use it for this purpose, rather than allow the insects to mature in a standing tree and be free to attack its neighbour as the insects arrive at their winged stage.

It must be understood by those who are unacquainted with insect life that it is not the mature insect which causes the damage to the trees, but the *Larvæ* or *Worms* which hatch from the egg, laid by the mature insects.

To summarize the above—

1st. Cut down a suitable Palm tree and divide it into lengths some of which should be split.

2nd. Set a watch for the arrival of the insects, catch and destroy night and day until no more are seen.

3rd. The decayed material of the cut tree should be searched for *larvæ* which may have been hatched from eggs deposited by beetles which escaped observation, and the remainder of the tree should be burned, as soon as dry enough for the purpose.

The mature insects though large are quite harmless and may be collected by women or children, and can readily be destroyed by a slight blow.

In connection with the above it may be mentioned that the Gru-gru worm or *Larvæ* of the Palm beetle is considered a veritable *bonne bouche* by many Trinidad families, and Palm trees are frequently cut so as to allow them to feed on the fermenting material until large enough for a table dish. The writer has seen them cooked, but

all he can say is, they smelt nice, and looked as good and as inviting as a shrimp, but how they taste he cannot say, for although he has seen other people eat and enjoy them, he has to confess to a want of courage to make the trial, although indeed he was tempted and almost persuaded.

673.—THEOBROMA PENTAGONA.

This species of Theobroma is one which furnishes a fine sample of Commercial cacao of excellent flavour. It is quite distinct from the ordinary varieties of *Theobroma Cacao*, and gives a "bean" nearly double the size of an average sample of that kind. The pods are five angled and the outer skin is invariably a greenish yellow. It was introduced to Trinidad from Central America by the writer in July 1893, and there are now numerous specimens in various parts of the Island. Being a new Cacao, with a fine bean, many enquiries have come to hand as to whether it is really a desirable species to grow with a view to exporting produce. This Department is not as yet in a position to answer such queries definitely, and the only recommendations it has given, is that the species deserves a fair trial at the hands of Trinidad planters, but that it would be unwise to plant too extensively until the results of primary experiments have been obtained. Planters should have the species upon their estates, and try it upon all kinds of land, but it is not at present recommended to grow it extensively. It has been found necessary to publish this information, as an impression has got abroad that it has been recommended by the Department in preference to the ordinary varieties.

674.—COCONUT PLANTING IN BRIEF.

SELECTION OF SEED.

Coconuts for planting should be selected from matured but not over ripe dry nuts. They should be taken from trees known to bear nuts of best quality. They should be picked and placed in a basket, and then lowered from the trees as the concussion by falling injures them.

SOWING IN NURSERY.

Lay the nuts gathered close together on a strip of sandy soil and slightly tilt up the stalk-end, cover with sand or mould, so that a fraction of the husk can be seen; over all place coconut leaves.

PLANTING.

Plant out in porous soil in prepared holes when shoots have appeared and grown to twenty-four inches high, together with a few roots, in such a manner that upper surface of husk is barely covered.

DISTANCE APART.

The distance to plant apart should range from 25 to 30 feet each way.

675.—AMYRIS Sp.

There is a species of *Amyris* growing in the arid Islands situated at the entrances to the Gulf of Paria; the waters of which are bounded on the east by Trinidad, and on the west by Venezuela, the highlands of which are plainly visible from the Town of Port-of-Spain on a clear day.

The plant grows luxuriantly on the rocky surface of these Islands, and has been referred hitherto, to the *Amyris maritima* of Jacquin.

The wood, leaves and flowers possess an aromatic principle, and small quantities of a strong smelling essential oil can be distilled therefrom.

This oil is said to be of medicinal value, and enquiries now in hand will probably show whether any grounds exist for this supposition.

676.—SWIETENIA MAHOGANI, *L.*

A WEST INDIAN REMEDY FOR RHEUMATISM.

Green wood and bark of the Mahogany tree has lately been demanded of this Department for the purpose of boiling down to be taken as a remedy for rheumatic swellings of the limbs. It is said to be used for this purpose in Barbados and other Islands.

677.—A PURPLE-LEAVED CANE.

Referring to our note on above in last issue, a correspondent kindly informs us that a purple-leaved cane is largely grown in Northern China.

678.—SHADDOCKS —(*Citrus decumana*).

This fruit and its variations, which are many and numerous, is not largely grown in the West Indies, and only occurs for the most part as seedlings in different districts. Some years since (December, 1896) a fine variety was brought to the notice of the Department by Mr. McGillivray, who favoured us with "graft wood" from which we successfully raised three plants. These were planted at the Experiment Station, St. Clair, shortly after its formation in 1898, and have produced fruit for the first time this year (November, 1904). The first fruit ripened was of excellent quality, and of a fine pink colour in its interior. In diameter the fruit measured nine inches. For some time past our Nurseries have been able to supply good plants of this kind budded on Seville orange stocks, and advantage has been taken of this fact by many of our cultivators. This class of fruit is also known by the name of Pumelo, Pomelo or Pommelo in the East Indies, and that name is also adopted here in some few instances. To enable cultivators to discriminate between the plant distributed by the Department, and others from outside sources, it proposed to name it "The St. Clair Shaddock," and under that name it will be distributed in future.

679. RUBBER PREPARATION AND CASTILLOA RUBBER.

In the Indian Rubber World of October 1st, 1900, I ventured to publish a *critique* of the articles previously published by Messrs. Biffen and Parkin in the Annals of Botany under the title of "Latex and its Functions."

The chief point to which exception was taken was the statement, —also included in paper read before British Association at Dover in 1899. That "*coagulation is now known to be brought about by the "proteids of the latex passing from a soluble to an insoluble state.*" "*Experimental evidence points to the proteid in question being "alkali-albumen rather than ordinary albumen. It has previously "been called albumen.*"

It was said moreover that the coagulation of the albumenoids of the Latex was necessary for the "coagulation" of the Rubber globules.

In our remarks it was stated that the aggregation or "coagulation" of the Rubber particles or globules of Rubber was independent of the coagulation of the albumenoids, as they could be aggregated, together, or coagulated quite as easily, if the albumenoids were removed, as in their presence.

In my paper I also showed that if the albumenoid liquors were drained off the resulting Rubber would be of much finer quality, and that the albumenoid matter could be easily removed in the case of castilloa latex by the simple process of creaming.

This criticism was answered by Mr. Parkin in a communication to the India Rubber World, of January 1901, in which he still appeared to insist upon his original point of view, namely, that the clotting or coalescence of the Rubber globules was contingent upon the coagulation of albumen.

Some time has now passed and the subject has again received attention at the hands of Dr. O. Weber of India Rubber Journal, whose articles on the subject treat of the line of practice which should be adopted. It is gratifying to note that he advocates the same methods as those described in our criticism of Mr. Parkin's work.

Dr. Weber treats the question by describing the fact that the coagulation of albumenoids will take place, and that in Rubber obtained by such a process, there is sure to be a very large proportion of resinous matter; while when prepared after the Latex is rid of the albumenoids a finer quality of material is obtained.

In his article Dr. Weber quotes our statement that 14 ounces of rubber was obtained from a single tree, while at same time estimating elsewhere that from two to six pounds could be obtained. He follows with a statement of his own that in an eight year old tree 14·2 ounces was obtained, and further states that the trees might be bled twice a year. This doubling of the yield would make Dr. Weber's return quite comparable with ours, as our 14 ounces was the result of a single bleeding, and it would therefore make our original estimate of 2 lbs. per tree practically the same as his own, a point which corroborates our statement as to yield, independent of the evidence afforded by our subsequent unpublished experiments.

The question as to the best means of tapping also shares the attention of Dr. Weber at (p. 131, Aug., 1904, I.R.J.) On this point there is undoubted evidence (in our experiments) that more latex can be obtained from horizontal than from vertical cuts. As to the question of the anastomosing of the milk ducts, our author states that there is "surprisingly little evidence," but it has been our fortune to observe an instance where the rubber of a Castilloa tree had formed and solidified in the milk ducts, and the bark having rotted away, it left a perfect cast in Rubber of the laticiferous system which was found to give direct evidence of their form. This cast showed *perfect anastomosis* of the ducts.

The contention of Dr. Weber as to the value of a vertical *versus* a horizontal cut, is in no way effected, as it was found that the largest channels were in a vertical position, the intercommunication being effected by minor channels issuing from the sides of the larger.

While it is certain that horizontal or spiral cuts or channels will cause more latex to flow, the adoption of the practice of making such, will rest almost entirely with the economy of labour in field work. Only experience can show which methods are most useful in the field, ascertained by the cost of tapping per lb. of latex, the injury to the tree, and the amount of waste; and such matters cannot be determined in the Laboratory.

It is clear that the greater facility is afforded in making the cuts, and the minimum of time in which the latex can be gathered, are important factors in the economy of Rubber collecting, as the cost of the methods of collecting Rubber from cultivated trees has hitherto been no inconsiderable stumbling block to the owners of plantations.

The invention of the new tool described by Dr. Weber is a step in the right direction, and working on the same lines we are now in possession of an instrument which allows still more freedom to the operator and enables him to make a narrow deep or broad channel at will, with ease and despatch. This instrument will be figured and described as soon as the manufacturer has obtained the necessary protection. It is sufficient for the present to say that by its use a greater control of the flow of latex can be obtained than by any other method yet seen by the writer.

Our recent experiments, the result of which was published by the Imperial Institute, show the value of Rubber at certain ages and it is now fairly proved, that the amount of obtainable rubber is increased as the age of the tree increases, and the amount of resinous matter decreases in proportion to the increase of Rubber, the tree being apparently able to convert this resinous matter into Rubber of Commercial value.

The question of the density or fluidity of the latex, is one which our experiments show is controlled almost entirely by the root system of each tree and the water supply it obtains, and the state of growth of the tree itself. If active, there are more fluids present, if dormant less are to be found, and the latex wants fluidity when trees are tapped at such a stage.

Whether it is an advantage or a disadvantage to have a more or less fluid latex, is a matter also for further experiment, as with a rapidly flowing stream more waste is almost sure to occur, than with

a creamy fluid, and probably a latex moderately thick will be found the most economical to treat.

It is admitted that the cultivator of a Rubber plantation has a difficulty to face, in obtaining his Rubber, as practically there is none, or little experience to guide, and he is in a measure compelled to "work out his own salvation." Experts who have collected Rubber in the forest, cannot be safely employed, as if the methods they employ in the wild woods were adopted on Plantations, *there would soon be no trees left to bleed.* Experiments should be promoted to enable proprietors to deal with and extract the whole of the Rubber from trees which have from some necessity to be removed, and why this should not be done in the field by certain solvents is a problem to be studied. Now, the Rubber contained in such trees is probably lost altogether, while they must contain a large amount of saleable material.

It has been seen that clean working of Rubber fluids has, as in Ceylon, advanced the price of material prepared by such methods, and it is fairly certain that more profit will accrue if such are adopted, than if haphazard and untidy methods are employed.

A simple method of obtaining rubber of good quality from Castilloa is to cream the fluids obtained, in two waters, and then after drawing off the second (from below as should always be done) to place the unconsolidated latex in a vessel made of wire gauze placed upon well washed and clean wet sand. The remnant of the fluids in the Rubber will then filter through, and as they disappear the Rubber globules will solidify into a cake of clean Rubber which can easily be removed and hung up to dry. Water should always be used in the vessels used for holding the latex as it issues from the tree, and it should be passed through a fine wire gauze with plenty of water for the first creaming.

It is important to note that Dr. Weber is an advocate for partial shade, such as our Bulletin has consistently advocated. He writes :—

"All reliable evidence seems to show that the trees grow badly in dense forests, and produce a poor yield of Rubber when grown on open ground. They appear to prosper best when growing up together with other trees, so that the trunk is always shaded, whilst the top of the tree at least, for a certain time during the day receives the direct rays of the sun. I entertain no doubt, whatever, that the last named condition is most favourable to the growth of the trees."

This opinion coincides with our experience both in the Forest and in the Plantation, as it is the condition in which we have observed them to thrive best in the country to which they are indigenous. There can be little doubt that the climate of Trinidad is exceptionally well suited for the growth of this tree, and that given a continuance of the prices of to-day, a good return to those investing in the cultivation can be confidently expected.

There will of course be the usual difficulties, but these should be overcome, as the cultivator gains the necessary experience. The best methods of tapping, preparing, harvesting, marketing have all to be learned. The industry is a new one, but if the progress already made is continued, and there appears to be no reason why it should not, then the prospects of the Rubber industry in Trinidad will certainly be highly promising and possibly fully secure.

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BOTANICAL DEPARTMENT.

BULLETIN
OF
Miscellaneous Information.

(QUARTERLY.)

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J. H. HART, F.L.S.

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680.—HOW TO TELL WHAT FOOD PLANTS WANT.

IN No. 72, Vol. IV, *Agricultural News*, January 14, was a short resumé of a paper from German sources on the study of the appearance of plants when they want certain constituents of plant food.

NITROGEN.—When they want nitrogen the leaves are said to lose their normal green colour and take on a clear green or a yellowish one, and to dry finally with a clear brownish yellow colour.

PHOSPHORIC ACID.—When phosphoric acid is deficient, the leaves take on a deep clear green, almost blue green. With a greater scarcity there appears on the leaves, first at the margin, and later on the whole leaf dark spots, and the leaf dies with a dark brown to a black green colour.

POTASH.—A scarcity of potash is said to be coincident with spotted leaves, the spots appearing in the margin, and later becoming distributed over the whole leaf, the stalk, mid-rib and veins retaining their green colour The leaf also curves or curls, with its convex side upwards, and finally dry up.

Our Cacao planters might usefully make observations on these points as they must be of considerable interest, and if they prove reliable, will readily afford them means of determining the wants of their Cacao fields in the way of manures. In fact, it is a short cut, which, if successful, will in a great measure do away with the necessity of analysis of the soil, always at its best, an expensive and tedious operation.

Like all many propositions however: it is in no way a new idea; as it has been followed by cultivators for generations. Many an observing cultivator of farm or garden crops can tell by sight without perhaps being able to tell the why and the wherefore, or able to describe the exact appearance of his plants; what particular manure they require to further their growth. They apply what they believe to be required, and if successful, they repeat it on the next occasion. It is this very thing that *Lille*, the great French Agricultural Chemist recommends the practical man to do, and it is as he says, a practical method of analyzing the soil of the field, by means of the plants it will grow.

681—THE SHAPE OF PLANT STEMS.

IN the Agricultural News of January 14th, 1905, a short note gives a summary of an article by Lord Avebury on the above subject.

The main features of the paper are very amply illustrated in Tropical Countries in the form and shape of our Forests trees.

Anyone walking round the Queen's Park, in Port-of-Spain, may see the principle described by Lord Avebury as, existing in British plants, amply illustrated in the forms of the stem and branches of our largest trees.

The Silk Cotton tree is an especially good example, for the buttresses so common at the base of the trunk of this and many other trees in Trinidad will as a rule be seen to be thrown out, directly below, and apparently for the support of, the weight of overhanging branches. In Kerner and Oliver's Natural History of Plants the subject of the formation of the parts of plants for some particular purpose is well treated, and many uses of the various parts of plants are clearly described.

Palms for instance, which require water near or closely surrounding the stems will be found to possess leaves which catch and conduct the water down the stem itself. This is often taken advantage of by natives who arrange on the stems of Palms small spouts which carry the water into receptacles placed for the purpose of storing it for household use.

With other plants which require water at a distance from the stem, leaves are to be found so constructed as to deposit the water exactly where it is required.

The subject is especially interesting to the plant student, and even to the amateur.

One of the curiosities of a Tropical Garden is the so called " Travellers' Palm " *Ravenala Madagascariensis*. This in reality is not a Palm at all. A tale is told that the name originated from the quantity of water which is collected by the leaves and stored in the base of their hollow axils for the benefit of travellers in a dry country. That the water is so stored, is a fact; but that it is intended to serve the traveller in a thirsty land, is rather discounted by the fact that the plant itself will not grow in dry district, but requires a situation where there is an abundant rainfall, and that when dry weather occurs, the water in the axils becomes ropy and almost putrid. The character of the receptacle however is one which prevents evaporation and water would remain for lengthy intervals, even during a season of excessive drought, and might possibly be the means of saving the life of a thirsty traveller. In all such stories there is generally an element of truth, and the writer must admit that it is quite possible for a traveller's life to have been saved by the Ravenala, but the evidence *per contra* would appear to be sufficiently strong to render the tale a doubtful one at the best.

That the form of the stem is however framed to serve a useful purpose is a proposition which can be fully proved, but it is generally more for the purpose of maintaining and benefiting the plant itself, than directly for the use of mankind.

682.—PHOSPHORIC ACID REQUIRED BY CACAO.

This matter has recently been treated from the purely chemical standpoint. It is the object of the writer to discuss it from the Agricultural point of view.

2. It is reported that some 35,000,000 lbs. of cacao are exported from Trinidad, and analysis shows that in this quantity, there is taken away some 515,200 lbs. or 230 tons of phosphoric acid. It is

recommended that this should be replaced by the use of basic slag as the cheapest material. It is important however for the agriculturist to examine into the following facts—1st how much need to be supplied, 2nd how much is naturally supplied, and 3rdly how much might be applied with advantage to produce a maximum yield.

3. In some places we hear of yields of five or six or even more pounds per tree, but taking the production at 35,000,000 lbs. that amount has probably come from as many as 35,000,000 trees in Trinidad or a yield of 1 lb. per tree for large and small trees alike. A tree on lands of the Botanical Department has yielded 7 lbs. of dried cacao at one picking. If it were shown that extra yield was due to the presence of extra phosphoric acid it would be strong evidence in favour of its application, but as yet, we await experimental results and the recommendation rests principally upon the inferences drawn from reasoning, "that what is taken away, must be replaced." That the amount of 230 tons is taken out of the soil there is no reason to doubt, but that it must need be all replaced *artificially*, is open to question.

4. How much need be supplied artificially can only be ascertained by experiment, as it is fairly clear that a certain amount must of necessity be supplied naturally, and again an uncertain amount, by what I have in previous writings termed the "incidental increment." How much this amounts to. we cannot say, but that such an increment occurs there appears to be little doubt, as how else could we explain the production of crops for years where no artificial stimulant or plant food has ever been applied?

5. If such an amount as 230 tons is carried away annually at the rate of ·23 ounces per tree, taking the yield for convenience at 1 lb. per tree, it is seen that in 50 years some 11 lbs. 8 oz. of phosphoric acid per tree has been carried away during that period. There are not a few estates in Trinidad where the average per tree is much higher than 1 lb. and for every pound or portion thereof a proportionate amount of phosphoric acid must be taken away per tree. Too much of one constituent is known to be prejudicial to growth, and if the total amount of 11 lbs. 8 ozs. or a 50 years supply was stored originally in the soil (a not very likely contingency) the plants would not yield to the same extent as if less were present. Now if 230 tons is taken away yearly there must either be a store upon which the plants can draw already in the soil, or it must be supplied from other sources not as yet too well known, or studied. If no material is added, and only a certain amount available, where does the plant obtain its supply, unless from some incidental source? Unless a supply is available the plants would be in danger of becoming barren, yet we know for a fact that many estates, where no artificial supply has been given have produced regular crops year after year for 50 years and over, which is strong evidence that undetermined sources of supply exist which annually provide a certain amount, if not the necessary quantity.

If crops can be increased by the application of phosphoric acid, it would tend to show that an insufficient quantity exists in soil, or is unavailable. but if the crop is not increased by artificial applications, it would be direct evidence that the natural supply is sufficient.

It will be seen that the amount required per lb. is only ·23 ounces or less than one quarter of an ounce, and if we watch closely the occurrences in the field, it is fairly certain that a large proportion if not all of this amount may be naturally supplied, by various, apparently small natural agencies, coincident with bird, insect, animal, and plant life.

To take for granted that it is necessary to supply artificially, a certain amount annually to be taken up by the crops, is therefore untenable: and the necessary amount to be supplied can only be correctly ascertained, by careful experiment.

It is found that the addition of certain proportions of Basic slag will improve the bearing of a plantation, it will then be the duty of the planter to ascertain, whether the extra cost, is equal to the increase in production. In many instances this will probably be the case, and in some instances the cost of artificial manures will be justified by an increase in production.

What the planter wants to know is; what is the amount of the natural supply, and what is the right proportion to be added to obtain profitable results. Having ascertained this, his judgment will tell him what course to follow in the application of artificial supplies of plant food.

A knowledge of the amount of the stored supply may be obtained by chemical analysis; but the incidental supply evidently cannot be obtained by this means. Once the stored supply is known, the amount required by the plant in addition can be ascertained by experiment, whatever may be the amount of the incidental supply.

From an agricultural point of view the earth is known to contain certain supplies of plant food, some of which exist in an unavailable condition, and may continue so, unless natural or artificial forces are applied to liberate it and make it available.

Analysis tell us, how much of certain constituents the soil contains, but it is impossible by this means to show how much is actually ready or available at one time or how much becomes available, *each year*, for use of plants; so that although we may know exactly what food is in store, we do not accurately know how much of it becomes available.

It is clear therefore, that this must be ascertained by experiments, such are already instituted under the direction of the Botanical Department with most encouraging results.

683—A STALK-EYED CRUSTACEAN.

"Specimens of a stalk-eyed Crustacean received at this Office from Mr. J. H. Hart, F.L.S, Superintendent of the Royal Botanic Gardens, Trinidad, referred to in the *Agricultural News*, (Vol. III, p. 380), have been identified at the British Museum (Natural History) as *Hippa emeritis*, Linn. Mr. Calmon, replying to the letter of the Imperial Commissioner of Agriculture, states that the species 'is widely distributed on the coast of North and South America.'

Mr. Hart in a letter accompanying the specimens wrote that they were brought in by Mr. H. A. Nurse, Agricultural Instructor, from Cedros, and it is reported that the peasants use them for food. They are about $1\frac{3}{4}$ inches long and resembles the prawns and shrimps in the appearance of the carapace (*cephalothrax*), and the crabs in the structure of the tail (abdomen). The species live in the sand of the shore. One American species is called the Sand bug, from its habit of burrowing in the sand."—(*Agricultural News*).

To the above may be added that J. R. Lechmere Guppy, Esq., has called attention to the fact of its having been previously collected in Trinidad, and has given references to works in which it has been recorded.

The name by which it is locally known is "*Cachicam*," It is used as food by the working classes, a fact which is apparently new to the British Museum authorities by whom it has so kindly been determined.

684.—CANE *vs.* BEET.

The following cutting from the *Louisiana Planter* once more discusses the relative sweetness of Beet and Cane Sugars. Those who know most about it are well acquainted with the difference, but those who know little require to be told more than once, that Cane Sugar is superior to Beet Sugar under equal methods of manufacture. Tea is spoiled utterly, the pudding is made less enticing, the whisky toddy has a perceptably different flavour, and the children's teeth are more subject to decay whenever Beet Sugar is used in preference to that derived from the Sugar Cane.

The Relative Sweetness of Beet and Cane Sugars.

"This much discussed subject comes to the front quite frequently, and once again, now, from the Sugar City, Colorado, where the *Saccharine Gazette* has on exhibition some candy made from beet sugar that it says "has Lowney's candy beat all 'round the block." This candy was made in Sugar City from sugar manufactured from beets grown in Sugar City, and may be candy par excellence, and made from sugar par excellence.

There would seem to be no proper disputing that cane sugar and beet sugar are the same product economically and, when strictly pure, will probably have the same degree of sweetness. The trouble is with the impurities. The larger part of the impurities can readily be removed from any manufactured article, but their final removal, the complete separation in the process of manufacture, would ordinarily be more difficult with sugar, or other article that requires great skill.

It is a well recognized fact that molasses is one of the cheapest sources from which to procure alcohol. Within a few years tens of thousands of barrels of molasses have been thrown into the river in this state and in the Sandwich Islands they are even now using it as a fuel, or as a fertilizer. Molasses, then, being so cheap and yet so effective as an alcohol producer, one would wonder why there is not a greater demand for it for producing alcohol in preference to the use

of corn, which, during the past year, has been comparatively high. The trouble is that alcohol being used as a basis for the manufacture of medicines, perfumery and similar articles, must be neutral so far as any special flavour is concerned. It must contain alcoholic strength, but without any special flavour. Alcohol made from molasses too frequently carries with it a rummy flavour and odor, and the final removal of this very slight impurity, from an alcoholic point of view, is extremely difficult, notwithstanding the great skill displayed by the modern distillers. Alcohol can be made from corn more readily, and any slight defect in the distillation does not leave in the alcohol such an odor as to indicate its origin, as does alcohol carrying a molasses odor.

Hence, we find that when white, refined sugars are made from beet or cane sugar, these sugars are absolutely flavourless. Such sugars should contain 99·5, or more per cent. of pure sugar, and perhaps a quarter to a half per cent. of moisture, but it is almost impossible to secure beet sugars of such very high purity as not to retain a trace of the disagreeable odor of the beet. "You may break, you may shatter the vase if you will, but the scent of the roses will cling to it still." Or let us paraphrase thus "You may boil and refine beet sugar if you will, but the scent of the beet will cling to it still." And that's what the matter with beet sugar."

685.—CACAO DISEASE.

Specimens of a disease attacking cacao trees was exhibited in bottles at the meeting of the West Indian Agricultural Conference held in Trinidad in January, 1905.

The disease is clearly due to a fungus of a peculiar character which spreads over the leaves and branches.

Similar specimens having been noted by Mr. Leslie, Agricultural Instructor, in a certain district in Trinidad, in small quantities. These have been referred to the authorities of the Imperial Department of Agriculture who provisionally pronounced it to be "almost certainly identical with that from St. Lucia."

So far as we know at present, there is no occasion for alarm; but at the same time, it is clearly necessary that a careful watch should be kept, and any tendency to spread should be carefully noted.

An effort will be made by the Trinidad Department to check the growth of the disease at once, and further reports will issue, if the disease appears likely to become permanent or to do serious damage.

Specimens of the disease will be secured shortly and will be accessible to the planting community, in order that planters may note its form and appearance, and thus be able to give early notice of its occurrence, if it reaches their district.

As yet little is known of it except that it is a fungus quite likely to spread. *It may not do so,* and it is hoped that it will not be found to be widely distributed.

686.—CUBA'S AGRICULTURAL EXPERIMENT STATION.

The following notice of the institution of an Agricultural Experiment Station in the Island of Cuba, should not we think be allowed to pass without a word of welcome from the Trinidad Station. The importance of Agricultural pursuits in the Island of Cuba has been recognised, we are glad to say, by the appointment of an able staff to govern and control the new station, and we wish it a successful and prosperous career:—

"Cuba is determined to avail herself of all the resources of modern technology in her agriculture, and has now fairly launched her first agriculture experiment station. Prof. F. S. Earle has been named as its director. He had already been appointed by the U. S. Department of Agriculture to take charge of the American station in Porto Rico, but, on the request of the Cuban government for a competent man, Prof. Earle, with the consent of the department, and on its recommendations, consented to go to Cuba. Prof. Earle has long been a student of scientific agriculture, has been a fruit grower and shipper on a large scale, and occupied the position of horticulturist at the Alabama Experiment Station, and of Professor of Biology at the Alabama Polytechnique Institute. He resigned the latter position to go to the New York Botanic Gardens where his work brought him into close relations with various parts of the West Indies and caused his final selection for the Porto Rico station.

"The Department of General Agriculture will be under the management of Prof. Francisco B. Cruz, and the principal agricultural crops of Cuba, including sugar cane, cotton, tobacco, corn, &c., will be under his direct management. Prof. Cruz is a graduate of the University of Havana, and during the past five years has been Secretary of the Junta Provinciale de Agricultura of Pinar del Rio and more recently he has been director of the agricultural department of the new Central Agricultural Station, and has inaugurated many investigations in the matter of cultivating, fertilizing and irrigating sugar cane and tobacco.

"The Department of Horticulture will be under the cotrol of Prof. C. F. Austin, who has served as horticulturist at the Montana Agricultural Experiment Station, and as assistant horticulturist at the Alabama Station, and as horticulturist also at the Maryland Experiment Station, resigning the latter position to accept his present place. The acting chief of the Central Agricultural Station is Mr. Miguel Esnard, a Cuban graduate of the Louisiana State University, where he made a special study of sugar chemistry. His experience in Louisiana will doubtless be of great value to him in taking up a similar line of duties and investigations in Cuba.

"Prof. C. F. Baker has been given the direction of the Botanical Department. He has been devoting years to this study and in various states of the federal union. Dr. Mel T. Cook has been named as the chief of the department of vegetables of the Cuban Station. Dr. Cook was a professor at the DePauw University at Greencastle, Indiana, for nine years, and for the past two years has been special lecturer at the Medical College of Indiana at Indianapolis.

"This corps of excellent workers, men familiar with every phase of modern agriculture, will certainly give a great impulse to the industry in Cuba, and we may look for the development of wonderful things in tropical agriculture in Cuba during the next decade."—*Louisiana Planter*, 14th January, 1905.

687.—AN EXPERIMENT WITH THE PALM BEETLE.—*Rhyncophorus palmarum.*

In the Bulletin for January, a short account was given of measures necessary for the destruction of this enemy of the Coconut Palm. We have since carried out the experiment of cutting a Cabbage Palm with a view of ascertaining how many beetles could be taken, from the trunk when cut to pieces.

The tree was cut on Thursday, 2nd February, and 48 hours afterwards the first lot of beetles were taken. Previous to this not a single beetle could have been found, but the attraction of the partly soured cellular tissue brought the following numbers, which were captured twice a day--morning and evening.

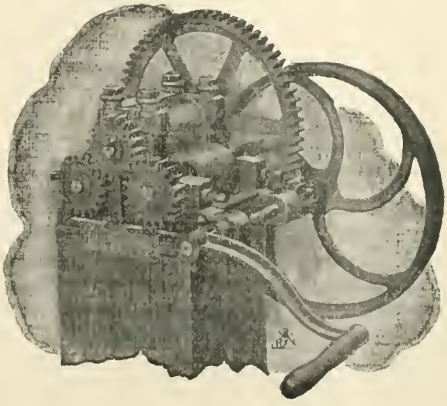
4th February, 1905	...	...	23
5th ,, ,,	...	...	19
6th ,, ,,	...	...	6

Several beetles were found to have pierced the interior of the stems, for the purpose of laying their eggs, but after the 6th, there was apparently little attraction and no more beetles were captured.

On opening the section of trunk on 18th February, it was found that a number of Larvæ were present, which had been evidently hatched out from eggs laid by visitors previous to capture. It is proposed to count these at a later date, when full grown.

688.—A HANDY CANE MILL.—(*Illustrated.*)

Some few years ago we purchased a small American three-roller cane mill for use at the Experiment Station. This mill has been found very effective and useful, extracting as much as 60 per cent. of juice (by weight) from various qualities of canes. By the courtesy of the Agents we are able to illustrate this mill for the information of our readers. The sole agents in Port-of-Spain are Messrs. Edgar Tripp & Co.



689.—SUN SPOTS.

Our Attention was called by C. S. Cochrane Esq., Chief Officer of the Survey Department of Trinidad to the appearance of spots on the Sun on February 1st.

On February 5th a direct observation was made at St. Clair Meteorological Station, and three large spots were noted placed in the form of an irregular triangle. The largest spot was encircled by many minute spots in its immediate vicinity, while the second and third in size, were clear black dots only. The same spots, one of which had apparently divided in two, were observed the following and successive days, and appeared to be moving across the face of the Sun. This is due according to an English Paper to the regular revolution of that body.

An observation taken on 18th February, showed that they had entirely disappeared

So far, the appearance of the spots, (which are said to have an effect upon weather) do not appear to have affected our West Indian seasons.

The following notes with regard to their appearance appeared in "Daily Mail" received by latest arrival from Europe:

GIGANTIC SUN SPOT.

COLLECTION WHICH COVERS 170,000 MILES.

"Astronomers are much excited by the recent appearance of a gigantic sun spot. The spot was first seen last Saturday; it is now near the east 'limb' of the sun, and will be at its greatest towards next Saturday, as the sun takes about twenty-seven days to revolve on its axis.

"This particular spot is a collection of smaller spots, and it was explained yesterday at the offices of the Royal Astronomical Society in Burlington House that for smaller spots to mass together and also for a large spot to break up were common occurrences.

"The sun spot apparently extends over six degrees of solar latitude, that is to say, roughly some 170,000 miles, which is exceptionally large. Professor C. A. Young, of Princeton University, a cautious man, speaks, in his book on 'General Astronomy,' of 150,000 miles as being abnormal for the penumbra surrounding a group of spots.

"Naturally astronomers are observing the phenomenon very closely, and at Greenwich photographs are being taken whenever possible. Sun spots occur in regular cycles of about eleven years. What they are has not yet been definitely settled, but an official of the Royal Astronomical Society declared his firm belief in the interdependence of sun spots and earth magnetism, maintaining that the curve lines of sun spots and magnetic storms tallied year by year too closely to be merely coincidences."

690.—THE PREPARATION OF FRUIT PULP.

The Journal of Board of Agriculture, 4, Whitehall Place, London, S.W., for January, 1905, contains an excellent article on the above subject. As it is of considerable importance to the grower of tropical fruit to get his fruit to market in proper condition, it may perhaps be of service to our cultivators if they can apply locally some of the methods advocated for the preservation of fruit, and the article is quoted for that purpose.

Considerable difficulty has been found to arise in getting tropical fruits to market, and it appears that by the suggested method a means is available, which will enable the British operator to deal with large quantities of West Indian produce and to put it on sale in a form which would be acceptable to the British buyer.

Preparation of Fruit Pulp in France.

Pulping is a useful method of preserving fruit intended for jam-making. It enables the fruit to be sent long distances and to be sold out of the season when the market is not overstocked. The practice prevails to a considerable extent in some parts of France, particularly in the neighbourhood of Dijon, in the Côte d'Or, whence the pulp is exported to this country, and in the Departments of Bouches du Rhone and Vaucluse. Briefly, the method is to sterilise the fruit in tins after the removal of the stalks and stones and when carefully prepared the pulp can be preserved for a long time. The black currant, cherry, raspberry, red currant plum and apricot are treated in this way, but the demand for the pulp in France varies with different fruits; thus the black currant, apricot, and plum are readily disposed of, but the red currant meets with less demand, while in the case of cherries, buyers of any considerable quantities are hard to find. The preparation of these pulps forms the subject of a Report to the French Ministry of Agriculture by M. Vercier, Professor of Horticulture at Dijon, and some of the particulars given in his Report may be of interest to fruit-growers in this country.

The black currant appears to be the fruit most largely preserved in the Côte d'Or, and since 1897 it has been exported to England under the name of black currant pulp for the use in confectionery. The crop in this Department amounted in 1903 to about 19,400 cwt., and in a good year it may reach 25,000 cwt. It is estimated that about one-half of the crop is sent to this country. The pulping is not usually performed by the growers, as the work requires to be done on a fairly large scale. The utensils required include a vertical boiler for generating steam; two pans, holding about 6½ gallons each, well made of stout copper, with spouts to pour out the contents and levers for tilting; and a metal tank for sterilising. Both the pans and the tank must be constructed so that they can be heated with steam from the boiler. The cost of an installation for making about 60 cwt. of pulp a day, including fixing is estimated to cost in France from £120 to £160.

The method of preparation is as follows:—The currants are freed from their stalks by women, at rates varying according to their skill of from 110 to 240 lb. a day each, so that a factory dealing with 60 to 80 cwt. daily would require probably fifty women or children for

this work during the season. After the removal of the stalks, the fruit is put into the copper pans, about 17 lb. at a time, with rather less than a pint of cold water; steam is introduced into the false bottom of the pan and the fruit heated to boiling point, it is stirred with a wooden spoon, and after boiling for one minute the steam is shut off, the fruit emptied into receptacles and immediately put into tins and carefully soldered up. These tins weigh when filled, and including the box, about 11 lb. They are then placed for twenty minutes in a tank of water which is heated by steam to boiling point. During this time it can be seen if any of the tins leak, in which case they are taken out and re-soldered, after the air has been allowed to escape. The tins are packed in wooden cases containing ten each, *i.e.* about 1 cwt. gross to the case. Only about 88 lb. of fruit are required for 1 cwt. of pulp gross, the difference being represented by the weight of the tins and the added water.

The cost of preparing and exporting the pulp to London is estimated by M. Vercier to be about 8s. 10d. per cwt. case of ten tins, made up as follows, exclusive of the cost of the fruit:—

	s.	d.
10 tin boxes...	4	0
Soldering	0	6
Removing stalks (88 lb.)	1	$7\frac{1}{4}$
Cost of preparation, coal, &c.	0	$1\frac{1}{4}$
Case for Packing	0	10
Sundries and carriage	0	6
Carriage: Dijon to London	0	$6\frac{1}{2}$
Interest on capital, depreciation, &c. ...	0	9
	8	10

If the pulp is sold in London at an average price of 28s. per cwt., there remains a balance for the manufacturer of 19s. 2d. Contracts are commonly made with the growers for the supply of fruits for periods of ten or twelve years of varying prices, of which 12s. 9d. per cwt. may be taken as an average. The prices obtained by growers who do not sell by contract vary very much according to the season and other circumstances.

Red currants and raspberries are prepared in a similar way to black currants.

In pulping cherries, the stalk and the stone must be removed, and women accustomed to the work can stone about 11 lb. per hour. They use a simple tool for this purpose, consisting of a flattened copper wire bent in the shape of a U with the ends fixed in a wooden handle. The fruit is treated in the same way as black currants, except that if it yields enough juice to prevent it sticking to the pan, water need not be added. Only large black cherries are used, the white heart cherry not being employed at all; the Montmorency is preferred, the Bigarreau being less suitable.

Apricots and plums require to be quite fresh, and for these fleshy fruits the sterilisation must be carefully carried out. After stoning, which is done by hand, the fruit is put in perforated copper vessels

and plunged into boiling water; they are kept in this for about one minute if the fruit is quite ripe, and from two to three minutes if unripe. The skin should slip from the fruit if it is squeezed between two fingers, but in order to preserve the shape of the fruit actual cooking should be avoided. On removal from this bath they are put into tins so as to weigh 11 lb. including the tin, and soldered down for further sterilisation, as in the case of black currants. Apricots with a brilliant red colour are generally selected, and the varieties considered most suitable in France are the Kuizet, the Muscat, and Blanc-rosé. The apricots are stoned by women at the rate of about 5d. per cwt., and the stones are dried and sold to firms who use the kernels, the average price obtained being about 5s. 2d. per cwt.

For preparing the pulp of fleshy fruits, such as plum, apricot, &c., some manufacturers use the simpler and less costly method of heating over a fire. The pan is placed or hung over the fire, and the fruit is protected against being burnt by the addition of more water. The tank or bath for sterilisation can in the same way be fitted over a fire.

The quality of the tins and the manner in which the soldering is done are of first importance. The tins may be made with the top in one piece, which is soldered on after the fruit is put in; or there may be an opening in the top lid, which is covered by a capsule and soldered as in the first case. For acid fruits, such as currants and raspberries, the interior of the boxes must be glazed, but this is not necessary for apricots and plums.

A serious matter in the preparation of the pulp is the difficulty in keeping the fruit for more than a few days and in procuring sufficient hands to remove the stalks and stones. In order to prolong the period of manufacture, experiments have been carried out by M. Vercier as to the effects of cold storage on five lots of black currants gathered at different stages of maturity.

Lot No. 1.—These were gathered while still green, fifteen or eighteen days before maturity, and kept perfectly for one month (24th June to 24th July), from which date they gradually withered and dried.

Lot No. 2.—These were gathered twelve days before maturity, and kept in good condition for forty days.

Lot No. 3.—These were gathered nine days before maturity, at which time they had been quite black for two days; these kept for forty-two days, and on the fifty sixth day, though withered, they were still healthy.

Lot No. 4.—These were gathered nearly ripe, some five or six days before maturity; they kept perfectly for forty-six days and were good for twelve days later.

Lot No. 5.—These were gathered when quite ripe; they kept fresh for twenty-six days, but nine days later they showed slight signs of withering.

Where fruit need only be kept for eight to ten days, a cool cellar will suffice if the fruit is put in airy packages of medium size, *i.e.*, holding about 45 lb. For longer preservation recourse must be had to a cool chamber or ice-house.

691.—BIRDS USEFUL, DESTRUCTIVE OR OBJECTIONABLE ?

The European Rook or Crow* has little in common with the "Corbeau" or "John Crow" of the West Indies, but similar discussions arise as to their usefulness, and scientific men are about equally divided in opinion as to their usefulness and their destructiveness. A report published by the German Agricultural Society contains an account of an interesting experiment conducted with a view to ascertain what amount of food was consumed by the European and what was its character for the purpose of ascertaining whether the popular ideas as to the habits of the bird were supported by sufficient evidence to determine whether or no, the birds were friends or enemies. The result of the enquiry has been that the evidence in favour of usefulness was considerably the strongest and the author of the enquiry concludes as follows: The "*investigation shows that crows and rooks are on the whole, more useful than harmful and especially in the breeding season. There can however be no doubt that when the birds at times occur in excessive numbers, and where damage becomes serious their numbers should be reduced.*"

This verdict has considerable bearing on a recent decision to exterminate, or decrease the number, of the scavenger vultures (*Cathartes atratus*) which are common to Trinidad.

In this case perhaps the decision as to numbers is more applicable than that as to damage, but it is hoped our City fathers will not be moved by fear or favour, and will not set down naught in malice against a bird, which, whatever else he may be, certainly serves them without fee or reward as an efficient and faithful Sanitary Inspector, capable of detecting breaches of regulations far quicker than many of the officers now charged with the duty.

692.—METHODS OF TAPPING RUBBER TREES AND COLLECTING LATEX.

A visit of inspection which I recently paid to the various rubber plantations in the Federated Malay States, shewed me in a way that figures and statistics could not have done the amount of labour and capital that has been spent in this industry, and brought very vividly home to me the great value of the plantations to the country and gave me some slight idea of the wealth of return immediately coming to those who have interests in these estates. But it also demonstrated the state of chaos that exists in all that concerns the practical harvesting of the rubber. That this should be so is inevitable, and at it no surprise can be felt when it is remembered that as an agricultural industry rubber growing is in its infancy, and that there is no accumulated experience gained by planters in the past to serve as guide. It is true that different experiments on a small scale have been made, and small amounts of rubber turned out and exported, but no large estate has yet been thoroughly tapped and no method at present in

* "Enquiry into Food of Rooks and Crows in Germany by Dr. Schech."—(*Journal of Board of Agriculture*, London).

use has been put to the test of practical applicability in a systematic manner to a large estate of, say, 1,000 acres. I propose to review the methods that have been put forward and which have in a mild and tentative manner been adopted, and to endeavour in a scientific manner to critically examine the probability of their success on a large scale and to give some scheme which as the result of this analysis may be adopted. In the first place the aim of all and on this one and only point, is there anything like full agreement, is to make money, that is to say to obtain the greatest possible return of rubber with the least possible expenditure, without doing damage to the trees, without killing the goose that is to lay the golden eggs. Each system of tapping therefore, must be looked at from the three points of view, namely the return of rubber, the cost of working and the probable damage to the trees as sources of rubber. Aesthetic and sentimental considerations can have no place.

The first and a simple system is that of single cuts, each being a few inches long, and obliquely set. The inclination being from 20° to 30° to the horizontal. At the lower end of each cut, a cup is fixed by being pushed into the bark, the portion of the bark thus raised acting as a lip over which the latex trickles into the cups.

On successive or on alternate days the lower face of the cut is pared off and the latex caused again to flow. This process, continued for about fifteen times of re-opening, has with individual trees yielded a large return of rubber per tree—some claim that the largest returns have been obtained in this way. It is also claimed that the scars heal quickly. That the returns per length of cut surface are any greater with this method than with any other I very much doubt. Experiments made with a few trees or with small sets of trees are certainly of value, but in so far as they are not carried out under the same conditions of cooly labour and rate of working as would obtain on a large estate in actual practice must be accepted with reserve, and until tests have been made on an estate over a considerable area by estate coolies I consider the increased returns shewn by this system to be not proved.

There are on the other hand very real objections to this method. in the first place the cuts are scattered and irregular, and while no damage is done to the tree itself, yet the bark is greatly roughened and the topping surface rendered irregular and more difficult to work a second time. From my own observation, I am inclined to believe that the gaping of the bark produced by a first cut is out of all proportion to the material removed. It is rather like the effect of the first cut into a roast leg of mutton. Subsequent shaving and reopening widens the gape by the amount removed and by no more. Consequently a disjointed and scattered series of short cuts leads to a rough and scarred bark on which is difficult to work. But a second and more important objection is the number of cups required for such a style of tapping. Ten cups to a moderate sized tree—say 28 inches girth at 3 feet from the base, is a very modest allowance. It only requires a simple multiplication sum to shew that with 1,000 acres of 120 trees to the acre, and the plantation tapped entirely twice a year, each cut being reopened fifteen times, nearly 100,000 cups would be required daily, or taking each cup as weighing about one ounce, then

over two tons of cups would be carried out and used every day. The labour of washing and drying the waste of latex as scrap from the cups to say nothing of the wear and tear which is excessive, when they have to be forced into the bark of the tree in fixing, require it to be very clearly and definitely established that a superior yield of rubber results from this system of tapping if it is not to be entirely condemned. It certainly is not a system, which in the present state of our knowledge can be recommended.

Another system of tapping which I understand was first tried in Ceylon is to make single cuts in such a position that the end of one is two or three inches vertically above the beginning of the second. These two cuts are then connected by a narrow vertical cut.

The way in which this system has been evolved, is, I think easy to see. The number of cups required with single cuts and the labour involved in their use had, even with small estates, become considerable, and evidently by connecting the cuts in pairs the number of cups required would be halved. But if the intention be to economise cups and labour, this system does not go far enough, and in any case it is difficult to see the advantage of this fancy zig-zag cut over a single straight cut extending from the commencement of the first to the end of the second cut.

This system has, I consider nothing to commend it, and in the irregular scarring of the bark and difficulty in fitting in new cuts on subsequent occasions on the areas untapped, is a special difficulty.

A third system is that known as V cutting, and the name explains the arrangement perfectly. The original cuts are reopened from day to day as in the case of the system of single cuts. There is an economy of half the cups required on the single system, but there the advantage over that system ceases. There is, however, the same objection of irregularity and lack of adaptability to a systematic working over the whole of the tapping area of the trunk, together with the additional disadvantage that the apex of the V is a weak point where the bark and the wood are apt to be badly wounded.

The three methods already described are difficult to carry out on a definite system in such a way that the whole of the tappable area shall be worked over in a definite time. They involve an excessive amount of scarring of an irregular kind and require too many cups.

The two methods that remain to be considered are known as the herring bone and half-herring bone. The "herring-bone" is made as follows :—a channel is cut vertically from the base of the trunk to a height of two, three or four feet according to the size of the tree, branching from this central cut are lateral inclined cuts at regular distances apart and alternately placed to the right and left of the central channel. The half herring bone differs from the herring bone in that the lateral cuts are on one side only of the central channel and they are usually of greater length. On reopening, the central vertical channel is left untouched, but the lower face of each lateral cut is reopened.

The vertical channel is merely a conduit for the latex and the collecting cup is placed at the lower end of it. These two methods of tapping present some very real advantages, in the first place the

cuts are regular in position and can be easily and systematically arranged and that too in such a way that the whole of the area of the trunk can be tapped in a definite period of time, the number of cups is reduced to the minimum, only one or at most two being required for each tree.

If in addition a small metal spout, easily made by bending a slip of tinned iron, be fixed into the base of the tree at the end of the vertical cut, the cups need never be damaged by forcing their edges into the bark of the tree, but can be hung by a peg to the tree below the spout or merely placed upon the ground.

The central channel is never reopened nor is the spout removed during the whole of the time each tree is tapped and the latex is as clean as it is possible to have it.

The real and material advantages are the practical economy of time and labour in cup fixing, collecting and washing, the saving in wear and tear of the cups and in the number initially required, and added to these are the advantages of being able to work on a definite system.

It has been objected that the use of one central collecting channel leads to more "scrap" rubber, on account of some of the latex coagulating in that channel every day. This is certainly true, but the percentage increase is not much, and with the use of a washing machine scrap will be very little less valuable than fine rubber.

The half herring bone differs from the full herring bone in that the lateral cuts are made on one side only of the vertical channel. The cuts may be to the right or left as is found most convenient to the cooly in cutting, and the cuts are twice the length of those in the full herring bone.

This method will, I believe, shew advantage over the full herring bone in so far as it will adapt itself to the general right handedness of the cooly if all the cuts slope up from right to left, and this method of cutting is I believe the best that will be adopted.

The advantages may for the sake of clearness be recapitulated :—

The number of cups is a minimum. The wear and tear of the cups is reduced to the smallest value.

The method is capable of being systematically carried out on a large scale.

The plan of cutting is simple and adapted to quickest and easiest manual labour.

From the foregoing consideration it may, I think, be fairly assumed that the "half herring bone" is the method to be adopted, and it now remains to shew how the areas for tapping may be plotted out and systematically arranged.

Here I feel to be treading on rather dangerous ground in so far as lack of knowledge of practical planting may subject me to the accusation of meddling with things outside my own domain. That I have no intention of doing, all that relates to the tapping and collection of latex, the effect of wounding rubber trees, the age at which tapping may be safely begun and kindred subjects are fit and suitable

for discussion by any one who troubles to read the evidence by which controversial opinions are formed. But to return, assuming the half herring bone with lateral cuts half way round the tree, assuming the cuts to be reopened nineteen times and one-eighth of an inch removed an each of these occasions—taking the initial cut as being about half an inch in width, there will finally result a scar three inches wide. For the purpose of illustration we may suppose the trees after tapping are given a rest of six months and then again tapped, this time on the opposite side of the trunks, after another six months they will be again tapped on the original side, opening lateral cuts immediately below the original ones, at the end of a further half year the similar process will be applied to the opposite side of the tree. In this way, if the original lateral cuts were at intervals of six inches the whole of the area of the trunk suitable for tapping would be worked over once in two years, by which time the first formed scars would be completely healed.

It is clear too that each tree would be in use, that is being tapped, on two occasions of twenty days each during the year, that is to say would be in milk on 40 days in the year. It therefore follows that $\frac{5}{3}\frac{0}{6}\frac{0}{5}$ total number of trees fit for tapping must be tapped on each day. Making an allowance for days on which by reason of stress of weather, festivals, or other circumstances no tapping is possible, this fraction may be taken as equivalent to 12 per cent.

This may of course be divided into two lots of 6 per cent. for morning and evening tappings.

Whether each individual tree be reopened on each successive day or on alternate days will not affect these results, it would mean that different sets of trees would be worked on alternate days but each set would comprise 12 per cent. of the total trees.

The division of the trees into groups for morning and evening tapping will make it advisable to cut the central channel for the morning group on the South side of the truk that for the evennig on the north side of the tree so as to avoid the coagulation of the latex in the cuts by the influence of sunshine.

The preceding calculation can be put in general terms and a formula given thus,

Let W be the width of the first cut.
— w be the thickness removed by each subsequent cut.
— T be the interval of rest between successive tappings, measured in years.
— t be the number of times each cut is reopened.
— D be the days per annum when tapping is impossible.

Then the spaces to be left between the lateral branches of the herring bone are $\frac{t\,w + \mathrm{W}}{\mathrm{T}}$

The percentage of trees tapped daily $\frac{100\,t + 100}{365\,\mathrm{T} - \mathrm{DT}}$

The thicknesses are measured vertically in inches. By stating the matter in this condensed form the nature of the inconstant quantities is clearly realised.

Thus W the width of the first cut depends upon the tool used and the skill of the user, similarly for the value of *w*. If for instance *w* could be made 1/16 instead of 1/8 inch it would reduce the space between the side arms of the herring bone from 6 inches to $3\frac{1}{2}$ assuming the value for *t* to be constant. Whether this would be too close for practical work, whether the areas drained by the separate cuts would seriously overlap is not known, on this point experiments are needed, because it is certain that before long a special tool to cut a thin shaving not more than 1/16 inch will be available.

Then the value of *t*, the times of reopening, is at present not fixed. Various values ranging from 10 to 25 have been assigned as suitable. Experimental results are here needed, and probably each estate will eventually have a special value for this quantity. For the moment it can be safely assumed that 15 is not too high a value.

That the maximum value should be ascertained and always used is clear from the expression given for the percentage of trees tapped daily where it is seen that the percentage increases as *t* increases, this put into practical form means that more trees would be always available for tapping and the returns from the estate would be correspondingly greater. The most pressing need at present is that the limiting values for this quantity and for the necessary period of rest T be determined experimentally, until that be done the probable returns to be expected from estates can only be guessed at, and there is and can be no guarantee that the crop is not being partially wasted through neglect of harvesting it completely.

There are numerous details such as the shape of the cross section of the cuts, the collection of scrap, the preliminary addition of preservative to the cups, the cutting tool to be used, which I have purposely left untouched fearing that their introduction would tend to obscure the two main issues of the selection of the type of cut to be adopted and the way in which the adoption can be carried out systematically.

These details are for the field rather than the study, and if considered should be the subject of a special communication.—*Agricultural Bulletin*, Straits Settlement.

P. J. BURGESS.

R. C. 1770/04.

Resident Councillor's Office,
Malacca, 22nd October, 1904.

Sir,

You may like to notice in the next Agricultural Bulletin the enclosed list of prices received for a parcel of Para rubber prepared in the Government Gardens at Bukit Sebukor in Malacca under the supervision of Mr. F. B. Gagliardi, then an Officer of the Malacca Forest Department.

2. The rubber was dried without the addition of any acid whatsoever.

I have, &c.,

R. N. BLAND,
Acting Resident Councillor.

The Editor
Agricultural Bulletin,
Singapore.

Singapore, 4th October, 1903.

The Hon'ble R. N. Bland,

Acting Resident Councillor.

Malacca.

Rubber.

Sir,

We beg to confirm our respects of the 27th ultimo and now advise that we have received advice from our London friends of the sales of the following parcels:—

lbs.		s. d.	
$6\frac{3}{4}$	No. 1 Fine Clean Biscuits	at 5/8 per lb.	
$5\frac{1}{2}$	No. 2 „ „ „	at 5/7 „	
$6\frac{1}{2}$	No. 3 Good Clean Biscuits slightly darker	at 5/6 „	A/C Forest Dept., Malacca.
2	No. 4 Good Ball 1 inferior dark and sandy	at 3/9 „	

We expect to receive account sales shortly and will forward them with a remittance in due course.

We have, etc.,

PATERSON SIMONS & CO.

—*Agricultural Bulletin*, Straits Settlement.

693.—COST OF MILK IN NEW JERSEY, U. S. AMERICA.

"At the New Jersey Station, the average yield of milk *per* cow for four years, was 6,467 pounds. The average cost per year per quart including food, labour, interest on and decrease in value of the herd was 2·39 cents. The herd consisted of thirty cows."—*(Journal of Jamaica Agricultural Society, January, 1905.)*

Note.—In Port-of-Spain the price runs at from 6 cents to 8 cents per wine quart of 23 or 24 ounces—or at the least *four times more than* it costs in New Jersey—a *full quart* taken as 40 ounces.

694.—COLONIAL AND INDIAN EXHIBITION.

It has been decided to send Representatives to the Colonial and Indian Exhibition, and the nomination of Messrs. Carmody and Hart, respectively, Chairman and Secretary of the local Committee has been approved by His Excellency the Governor. Collections of the products of the Island are now being prepared and it is hoped that a fine show will be made. A good position for the Court has been selected by the West India Committee in London who are doing all in their Power to render the Show a success.

695.—AGRICULTURAL SHOW.

The triennial Show of the "Trinidad Agricultural Society was opened by His Excellency Sir Henry Moore Jackson, on Tuesday, February 14th and terminated on Saturday 18th instant.

The Exhibition was a satisfactory exposition of the products of the Island both major and minor, and in the quality of the samples there was certainly a great improvement, and fewer articles of inferior quality were staged.

A large number of suitable samples were secured for the Colonial and Indian Exhibition.

The Botanical Department exhibited samples of Essential Oils, Decorative Plants, Onions, Yams, Ginger and Dark Red Cacao and for the latter a *Diploma* for best sample was awarded.

696.—MULCHING.

We have so often advocated the practice known as mulching that it would be almost superfluous to recur to it for sometime to come, but the present short article afford such strong additional evidence of the economy of the practice, that I "clip" for the benefit of our Trinidad friends from the *Journal of the Jamaica Agricultural Society.*

"It is so easy, sometimes, to write or speak and tell the cultivator what he ought to do, but the idea of what one's advice involves should always be well considered. It is so easy for instance to say to a settler to say that after planting cotton seed in a dry district he must mulch thickly over his land with dry grass. The cutting of grass alone to thatch or mulch over an acre of land is a heavy task; then there is the spreading of it: then there is the drawing of it off into long lines, to enable the weeding to be done later; then the recovering. Yet this mulching if done, after rain, will almost assure safety from drought, and it is an investment of time or labour which will pay good interest. Not only is the soil thickly thatched with dry grass, kept cool and moist, but ultimately the mulch crumbles and leaves a good useful addition of manure on the soil. We are in for a spell of dry weather in the "spring" from all indications and mulching should be undertaken immediately, if it has not been done already."

697—STERILIZED FRUITS.

The following paragraph which is a record of an actual experiment carried out in the Tropics, is of sufficient importance to induce us to reproduce it in full.

For many years past it has been known that the essence of all preservative methods is to destroy the germs contained in the material to be preserved, and after that destruction, to prevent access of other germs.

This appears to have been effectually accomplished by the Jamaica Botanical Department and we hope during the ensuing year to have a similar experiment on sight at the St. Clair station.

"At the meeting of the Board of Agriculture held on Tuesday, the 13th December, the Director of Public Gardens submitted eight jars of fruit preserved by a simple process of sterilizing. This process is as follows:—Water is sterilized by heating to 150 deg. F., allowed to cool and next day the fruit is put into the bottles, the caps and clips are fixed on, and the bottles with the sterilized water are heated to 150 deg. or 155 deg. for four hours.

The total cost of the small apparatus by which this experiment was done, including freight is £2 5 5.

The bottles supplied with covers and rubber rings cost as follows:—

29 oz. size, 4s. 6. per dozen, 48s. per gross.

20 oz. size, 4s. per dozon, 42s. per gross.

Fruits are put up in exactly the same manner in Great Britain, and sold at the following prices:—Blackberries, 11s. per doz.; Red Currants, 12s. per doz.; Plums, 10s. per doz. The best dessert fruits put up the same way such as Apricots, sell at 15s.; Pears, at 13s.; Pineapples, 11s. 6s. The fruits put up are as follows;—Varieties of Mango, Pineapple, Banana, and Akee, and one of the jars being opened after being three months put up the fruit was found to be in perfect condition. This bottled fruit is on show at the rooms of the Agricultural Society, and we shall be glad to have anyone interested call and see. The whole apparatus together with bottles may be had from Messrs. Fowler E. Lee & Co., Maidstone, Kent, England.

698.—PERCENTAGES.

In a recent newspaper article exception was taken to a statement made in my notes on making chocolate in the issue of the *Bulletin* for January, 1905.

The critic, it may be admitted, has some ground for his complaint, but if he will kindly excuse the *lapsus calami* which gave him his objection, we shall feel obliged.

For the statement that "*makers add variable quantities of sugar; in some well known brands, as much as 60 per cent. of fine sugar is added to cake or roll chocolate so that 40 lbs. of roll chocolate would become 100 lbs. of the sweetened material*" read as follows—

In some well known brands, as much as 60 lbs. of fine sugar is added to 40 lbs. of ground cacao beans, which would thus become 100 lbs. of sweetened material or chocolate, and contain 60 per cent. of sugar.

699.—HOW A SMALL SETTLER SHOULD CURE HIS COFFEE.

To-day I had a visit from a gentleman with a small quantity of coffee which he wished prepared for the local exhibition. It was damp, dusky, dirty, dried in the "cherry" skin, and white with mould, smelling strongly of fungus growth. In Trinidad such methods are common and the following prize essay published by the

Journal of the Jamaica Agricultural Society will show our readers how to do such work and do it well, and we strongly commend it to all who are coffee growers in Trinidad.

HOW A SMALL SETTLER CAN BEST CURE HIS COFFEE.

THIS was the essay, on "How a Small Settler can best Cure His Coffee," which won the first prize in the Port Royal Mountain Agricultural Society's Competition in July.

"Before going into the best method for a small settler to cure his coffee, I venture to say the quality must be looked for in the cultivation, for no ill-grown coffee will ever be any good sample, no machinery nor care of any description will ever convert bad coffee into anything good. To assure good quality your coffee must be weeded three times a year, and properly pruned. When the field work is done, i.e., properly done, and the crop commences to ripen, you must see that your pulper is in good repair, for if there is anything that damages one's crop it is a bad pulper. I have seen out of two barrels of coffee only fifteen pounds of marketable coffee could be obtained, the balance was all bruised and pinched; some was cut in twain. The next thing to look after is your barbicue. It should not be a rough surfaced one, as it burns and damages the coffee. To build a barbicue is a very easy matter; it should be built with a slight slant from your draining tank or barbicue as the case may be. Gather up some large stones, rough face them, build a wall four sides square, gather stones and pack them regularly, and with a hammer beat them closely together in their places. When you reach about (8) eight inches of the wall, put on a layer of mixed concrete, consisting of lime, sand and small stones with sufficient water to make a set. If no sand can be had well sifted earth will do. For this purpose clear away the vegetable soil and use the sub-soil. The next thing is a plastor of lime, marl and water, then build a ledging edge on all sides round, eight or six inches around the surface of the barbicue, with a drainer or outlet at the lower end. Then make a grouting of lime and water to a thick paste, get a brush (even one made of a banana sucker will do) and rub over the barbicue morning and evening until it is quite dry without any crevice or crack. The last thing get some cement and make a wash, and wash the barbicue about three or four times, and you will have a good barbicue for your curing purposes. An old, broken up barbicue is a barrier to good sample of coffee. You can never have a good cured sample. Most of the sides of the beans will be burnt and bruised up while turning.

"After your coffee is picked it should never remain more than twenty-four hours to be pulped, care must be taken that no stones, nails, etc., are allowed to be mixed up with the coffee as it totally damages your pulper. Care must also be taken that no green berries are picked in the ripe as they help to degenerate the good quality of coffee.

"After it is pulped it should never remain more than 24 hours to be washed, and each day's pulping should be separate. If there is no sun it can remain in the tank for weeks while you have a running force of water on it, or if the water is changed every other day. To wash, it should be well scrubbed with a rake made of boards and well bounced on the sides of the cistern until all the syrupy or saccharine matter is washed off. Allow it to settle a few minutes and all the light and trash will float, these must be skimmed off. The light is cured aside for house use or to be mixed with the triage which can be sold for a small price in Kingston.

"After the coffee is washed and drained it should be thrown into the barbicue and well turned so that the water may be evaporated (sucked up) quickly. The coffee can be kept out in the barbicue for the first night, and then put up at evening and turned every morning to the sun. After the fourth or fifth days' sun it can be kept up without sun for some time. If put up before this the coffee gets fermented (into a boiling state) and gets spoiled. If your hand be pushed into the coffee every morning and it feels cold it is right, but if warm danger is coming, so it should be thrown out and exposed to sun and air for some time until when put up it feels quite cold. Coffee can be cured within two weeks under good sun, but I would recommend a slow mode of curing, not in a hurry. It is very easy to know when your coffee is cured. You can easily smell the essence of it, and if tried against your teeth will break very briskly. If rubbed against your hands the parchment skin will easily come off, also the silver skins. "the protector of the bean," and the bean will be in a uniform colour; generally greyish blue. After it is well cured it should be milled, that is, if you are not selling in parchment, which is a surer way than by spoiling same in a mortar beating it out and such like. As a mill and fanner are rare things for many small settlers you will have to hire one if you have none, as is done in many districts. The price is one shilling a trough generally, but it is left to the bargain you can make. To beat your coffee in mortar, is a poor and unthrifty way; it is better to sell in parchment, than to do so. After it is ground and fanned it should be picked, and by experienced pickers too, all ill-shaped beans, burnt sides, scarred sides, black and blighted beans, stones, sticks and every thing, save the good beans, must be picked out. No salt nor wet hands should be handled in the coffee. Coffee does not like a nasty smelling place, for it has a peculiar way of throwing off its own odour and gathering that of other bodies near it. Coffee must be put up in a clean hut made for the purpose.

"In conclusion, I may say, that if a Central Factory be placed among the small settlers in every district for the purpose of receiving and curing their crops under proper method, Jamaica will soon again be in a premier position.

"Co-operation is needed among the small settlers for the purpose of curing and handling their crops."—*(Journal of the Jamaica Agricultural Society.)*

700.—PURPLE LEAF CANES.

The following letter has been received from an esteemed correspondent Professor Kobus affording further information on purple leaf canes:—

"Pasoeroean, Java,
28th December, 1904.

J. H. Hart, Esq., F.L.S.,
Superintendent, Botanical Department, Trinidad.

Dear Sir,

In No. 44 of your *Bulletin of Miscellaneous Information* you ask informations about purple leaf canes. In the large collections of cane varieties, that existed here ten years ago and where nearly 500 varieties from every part of the world were brought together (after a very careful revision they were reduced to 199), I remember 3 varieties with purple leaves. Two were original from Java, one slender cane with dark purple leaves and a thicker one with bright purple leaves. Both canes are cultivated in Javanese gardens as a remedy against certain diseases; as sugar producers they were of no value. One variety was sent from one of the Polynesia Islands, if I remember well from Hawaii. Among the seedling canes raised by Mr. Moquette, once a purple leaf cane was remarked. Purple leaves seem therefore a mutation, that is not very rare.

I remain, dear Sir,
Yours sincerely,

J. D. KOBUS."

701.—A FREAK BANANA.

At the Agricultural Exhibition held in February at Port-of-Spain, there was exhibited a banana, showing both red and the ordinary yellow forms of fruit (*fingers*) on the one stem; one side of the bunch being quite a dark red, while the other was of the normal colour. The coloration extended from the fruit stalk along one side only, the same side of the bunch being coloured, while in some of the fruits (*fingers*) which appeared on the line which divided the two colours one side was red while the other was normal, but on the whole the line of colour was defined. The whole may, it is believed, be put on record as a *sport* or variation which may be useful evidence of the causes which have produced the red and various other varieties of the banana.

It is quite probable that similar instances may have been witnessed, and that the occurrence is not singular or unique, but it is the first that has been brought to the notice of the Botanical Department in this Island.

702.—A RECORD OF WORK IN AGRICULTURAL INSTRUCTION, FOR 1903-4.

The Annual Departmental Report for the year ended 31st March, 1904 contained the following remarks on Agricultural Instruction

which are reproduced here for the benefit of our readers, with slight abbreviations :—

"The share taken by this department in Agricultural Education, consists in supplying two trained men, under the title of Agricultural Instructors, who are detailed to visit every district in the Island for the purpose of (1st) affording Theoretical and Practical Agricultural Instruction in schools, (2nd) holding public meetings for the discussion of Agricultural Topics, (3rd) visiting the lands of the people to afford practical instruction in tillage, pruning, and other operations, and (4th) holding lectures in public places at which agricultural operations can be discussed and advice afforded to all enquirers. This work has been very popular and the demand for the services of the Instructors has been such, that it has been found impossible to meet all requisitions with the number of officers already appointed, and the limited provision allowed as a start. For the coming year increased provision for travelling has been made, so as to allow the Instructors to make more frequent visits to each district. As the effort is quite new to the department it was found impossible to arrange the work of the instructors in any regular or systematical manner, but it is hoped that in the coming year it will be possible to provide for more frequent visits to each district. A demand has been made in more than one place for resident Instructors. With the present staff, this has been found impossible, and could only be carried out by the appointment of more officers."

The following places were visited by the Instructors, the numerals in brackets indicating the number of visits to each place :—

Arima ... ... (6)	Cunupia ... (1)	Mucurapo ... (2)
Arouca ... ... (6)	D'Abadie ... (5)	Nariva... ... (1)
Balmain ... ... (2)	Diego Martin ... (6)	Oropuche ... (1)
Brasso ... ... (2)	Elswick ... ... (1)	Princestown ... (8)
Calcutta Settlement ... (3)	Erin .. ... (2)	San Fernando ... (18)
California ... ... (2)	Gran Couva ... (4)	Sangre Grande ... (4)
Carapichaima ... (2)	Guaico ... ... (1)	San Juan ... (7)
Carenage ... ... (5)	Icacos ... (2)	Santa Cruz ... (5)
Caroni ... ... (2)	La Brea ... ... (2)	Siparia ... (1)
Carreras ... ... (2)	Las Lomas ... (1)	St. Ann's ... (1)
Caura ... ... (2)	Laventille ... (2)	St. Joseph ... (5)
Cedros ... ... (5)	Longdenville ... (1)	Tacarigua ... (5)
Chaguanas ... (2)	Manzanilla ... (4)	Todd's Road ... (1)
Chaguaramas ... (1)	Maracas .. ... (4)	Tortuga ... (1)
Chatham ... ... (1)	Maraval... ... (4)	Tunapuna ... (8)
Claxton Bay ... (1)	Mayaro ... ... (1)	Valencia ... (1)
Couva ... ... (5)	Mayo ... ... (2)	Williamsville ... (2)
Cunapo ... ... (2)	Moruga ... ... (2)	

The following places were visited in December, 1902, and January, 1903 :—

Cedros (1), Grande Rivière (1), Great Matelot (1), Guayaguayare 1, Icacos (1), Matura (1), Mayaro (1), Nariva (1), Toco (1), and San Souci (1).

One hundred and three (103) schools were examined, and hints on proper formation and management of school gardens were given.

Three courses of lectures in Agriculture were given at the Government Training School in Port-of-Spain, and one course at the Naparima Training School, San Fernando. The second course at the

former school was attended by eight students from the Roman Catholic Training School in Port-of-Spain.

Arrangements were also made for a class to be carried on at the Boys' Reformatory, Diego Martin.

The following table shows the details of the work at the Training Schools :—

Name of School.	Course.	Number of Lectures given.	Average attendances per Lecture.	Average percentage marks at Examination	Remarks.
Government Training School, Port-of-Spain.	I	10	7·5	—	* At this course 8 students from Nelson Street R. C. Training school attended
	II*	12	13	55·5	
	III	8	10·5		
Naparima Training School, San Fernando	I	12	23	59·1†	

The following is a list of subjects with number of times treated, including training school lectures and those given in the country districts named in the first table.

Subject.	Number of times treated.	Subject.	Number of times treated.
Introductory	37	Insect pests and spraying ...	10
Cotton Industry	24	Pruning	20
Budding and Grafting ...	29	Manuring and mulching ...	49
Sowing seeds	29	Minor Industries	19
Fruit Industry	18	Soils and preparation of compost	8
Raising and Transplanting ...	10	Diseases of plants	22
School gardens	19	Potting and planting ...	11
Putting in cuttings and layering ...	27	Physiology of leaves ...	3
Preparation of vegetable beds ...	6	Physiology of stems ...	3
Estate management (general) ...	13	Plant life in general ...	12
Cacao cultivation, diseases ...	22		

SUMMARY OF WORK.

Average number of days travelling per month	7·4
Average length of journey—miles	53·8
Average length of journey—days	2·4
Total number of estates visited	109
Total number of schools visited	103
Total number of lectures and demonstrations	391
Total number of miles travelled	3,680

TRINIDAD. No. 47.

BOTANICAL DEPARTMENT.

BULLETIN
OF
Miscellaneous Information.

(QUARTERLY.)

JULY, 1905.

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Edited by Acting Superintendent.

TRINIDAD:
PRINTED AT THE GOVERNMENT PRINTING OFFICE, PORT-OF-SPAIN.
1905.

703.—NOTES ON EXPERIMENT PLOTS.

SEVERAL Experiment Plots have been established throughout the colony during the past year.

One of the most interesting of those is the Cacao plot at *La Vega* estate, Brasso, the necessary land being kindly handed over to the Government for experimental purposes by the Hon. C. de Verteuil, the proprietor.

It consists of about four acres of undulating land and is divided into four approximately equal sections, each of which receives a certain distinct treatment. The following abridged copy of suggestions issued for the control of such plots will show the lines on which the experiments are being conducted :—

1. That the area be divided into four equal parts.

2. Section A to be given ordinary cultivation as usually practised on estates in Trinidad.

3. Section B to be pruned, trees cleaned of moss and wounds to be tarred. Ground to be cleaned and manured on surface with pen manure. (Weight to be taken by weighing loads or baskets).

4. Section C to be pruned, cleaned, wounds tarred, ground cleaned manured with

   Sulphate of Ammonia @ 400 lbs. per acre, and

   Basic Slag @ 4 cwt. per acre.

   Manure to be pricked in with a fork.

5. Section D treated same as C, but manured with

   Basic Slag @ 4 cwt. per acre, and

   Sulphate of Potash @ 1 cwt. per acre.

   Manure to be pricked in with a fork.

6. Holes in trees to be filled with cement.

7. On all sections the total weight of crop in wet cacao to be taken for one year.

8. Arrangements to be made for pruning and cleaning so as to allow an officer of this Department being present.

9. No dead wood or broken pods must be allowed to lie on the ground in any section.

We have recently had the returns for the past year, and we now publish them here for general information. It will be interesting to compare those results with subsequent years as the effect of the manurial treatment will become more apparent, especially in those sections where chemical manures were applied.

L 29 1905

Results of Cacao Experiment Plots at La Vega Estate, Brasso, 1st April, 1904, to 31st March, 1905.

Plot approx. acre.	Number of full bearing trees.	Manuring Treatment. Per Plot.	lbs. per tree.	Expenses $ Manures.	Applying Manures (approx).	General Cultivation.	Total.	Yield lbs. Wet Cacao. Plot.	Wet Cacao. Per tree.	Dry. Per tree.	Value of crop per tree.	Total expenses per tree.	Profit per tree.
											cents.	cents.	cents.
A	235..	... .	...	...	...	9·40	9·40	1,447	6·15	2·93	21	4	17
B	215	Sulphate of Ammonia—400 lbs. ..	1·86	18·72 ...	$3 00	9·40	31·12	1,589	7·39	3·69	27	14	13
		Basic Slag—4 cwt.	2·08										
C	224...	Pen Manure—10 tons ...	100	4·80 ..	$6 00	9·40	20·20	1,571	7·01	3·39	25	9	16
D	216	Basic Slag—4 cwt.	2·07	8·08 ...	$3 00	9·40	20·48	1,813	8·39	4·20	30	9	21
		Sulphate of Potash—1 cwt. ...	·51										

N.B.—(1.) Value of crop is obtained from average price of cacao in Port-of-Spain market during year under review.

(2.) Plot D gives highest profit per tree.

(3.) The unmanured plot A gives the next highest, but it should be remembered that the full effect of the manures would not appear this year.

(4.) The manures were applied in four dressings, the first on the 28th June, 1904.

(5.) Mr. de Verteuil reported on the 28th February, 1905 :—"At present the manured plots look much healthier and have much more "fruit on the trees than plot A."

The Experiment Plot of cotton at Cedros proved a failure last year owing to all the bolls becoming diseased.

This year the plot is being utilised for the trial of other minor products. It is two acres in extent and has been divided into four sections of half-an-acre each. Each section is to be devoted to a different product, the four selected being,

1. Ground-nuts.
2. Pine-apples.
3. Gingelly.
4. Musk Ochro.

All the sections are to be treated alike and only pen manure is to be applied in the first instance.

On the recommendation of Sir Daniel Morris—Imperial Commissioner of Agriculture for the West Indies, Ground-nuts have been ordered from Barbados and Musk Ochro seeds from St. Lucia.

Parts of several of the sections will be planted with local seeds and suckers to compare with those obtained from other islands. Pine-apple suckers have been asked for in Jamaica and some of the local "Pitch Lake Pine," have already been obtained through the kind co-operation of Mr. T. I. Potter, Warden, La Brea.

The land for these experiments has been kindly lent to the Government by Mr. William Greig of St. Marie estate, Cedros. The plot abuts on the main road and labels are to be placed at the end of each section to show what the plot contains, and also the treatment it has received.

An Experiment Plot of Cacao has recently been started at *River* estate, Diego Martin, on similar lines to that at Brasso. *River* estate belongs to the Government and is under the control of the Botanical Department. About nine acres of the estate are now devoted to experiments in Banana cultivation.

704.—FRUIT SENT TO CRYSTAL PALACE EXHIBITION.

During the past two months consignments of fruit have been packed at the Experiment Station, St. Clair, and sent to the Trinidad Court, of the Crystal Palace Exhibition in England.

The following is a list of the kinds sent :—

Bananas ...	...	10 bunches.	
Plantains ..	...	3 ,,	
Green Coconuts	...	1 bunch.	
Shaddock :			
Large pink flesh	..	4 fruits.	
Papaw ...	...	4 ,,	
Mammie Apple	...	46 ,,	
Grape fruit	...	30 ,,	
Sapote ...	...	24 ,,	
Pine Apples :			
"Pitch Lake Pine"		12 ,,	
Mangos :			
"Gordon"	...	40 fruits.	
"Peters"	...	24 ,,	
"Belmont"	...	72 ,,	
Limes :			
Common	...	150 ,,	
Trinidine	...	12 ,,	
Citron ...	...	12 ,,	

They were packed in 31 cases. Each bunch of bananas was packed in an octagonal crate with banana trash, the mangos, and

papaws in shallow boxes just the depth of the fruit, each fruit being wrapped in tissue paper and made secure in a separate division of the box with wood wool.

From the following notice which appeared in the *Mirror* of the 21st June, it will be seen that some of the mangos arrived in such good condition as to be considered fit for presentation to His Majesty the King.

The King and Trinidad Mangos.

We have received a copy of the following correspondence, which cannot fail to produce much satisfaction and pride among Trinidadians.

The West India Committee.
15, Seething Lane, E.C.
3rd June, 1905.

My Lord,

I have the honour to send herewith a package of East Indian mangos grown in the Island of Trinidad in the West Indies by the Botanical Department of that Colony, and exhibited at the West Indian Court arranged by my Committee at the Colonial and Indian Exhibition at the Crystal Palace.

At the instance of Mr. J. H. Hart, the head of the Botanical Department, and Commissioner for the Island at the Exhibition, I beg respectfully to ask if you will be pleased to submit this fruit for the acceptance of His Majesty the King.

I have the honour to be, &c.,

(Signed) ALGERNON E. ASPINALL,
Secretary.

The Right Hon'ble
Lord Knollys, G.C.V.O., K.C.M.G., &c., &c.

Buckingham Palace,
5th June, 1905.

Dear Mr. Aspinall,

Your mangos have arrived, and the King desires me to return you his thanks, especially so to Mr. J. H. Hart.

Yours faithfully,

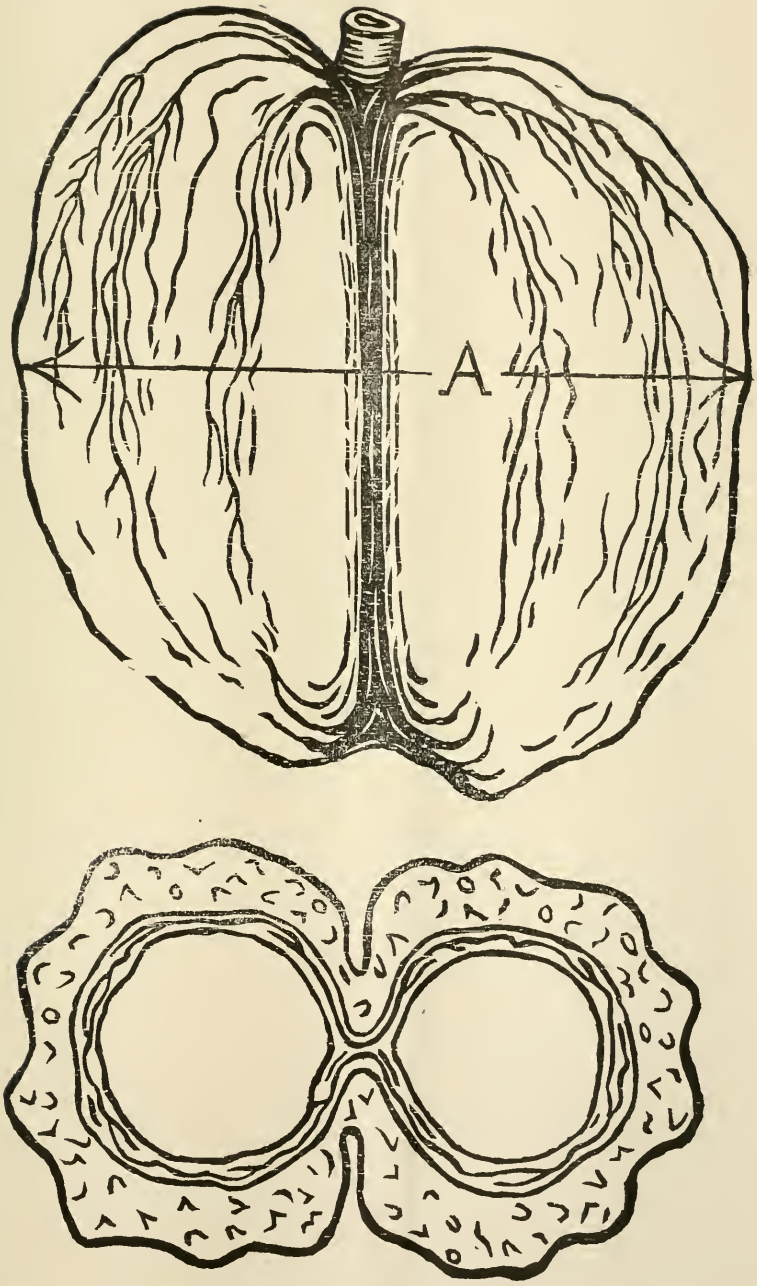
(Signed) FARQUHAR.

705.—DOUBLE CACAO POD.

A monstrosity in the form of a double cacao pod is shown in the accompanying figure. It was found by Mr. R. W. Gordon, of the Public Works Department, at River Estate, Diego Martin, on the 12th of April. Some of the oldest planters in the Colony who have seen it say that they have never seen a pod like it before.

We have seen double fruits of peaches of a similar formation to this growing under glass in Scotland, but we believe this to be the first record of a double cacao pod.

The specimen is being preserved in a solution of formalin in the Botanical Department Herbarium.



DOUBLE CACAO POD showing transverse section through A.

706.—GEOLOGICAL NOTES ON CACAO SOILS.

By E. H. Cunningham-Craig, Government Geologist.

The following notes have been written to serve as an explanation of the geological maps that have been produced, and to render them more valuable from an agricultural point of view, especially to those interested in the cacao industry.

In these short descriptions the word "rock" is used in the strict geological sense, to include sands, clays, and alluvium.

Soil, as has often been said, represents the excess of disintegration over transportation, an excess which is liable to be great under tropical weathering conditions. The value of a soil for agricultural purposes may be considered under two heads, chemical composition and mechanical compostion. With the chemical compositions of soils most favourable to the growth of cacao this report is not directly concerned, but it is impossible to treat of the nature of soils formed from different rocks without taking some account of the more important chemical constituents of these rocks, and these will be mentioned as need arises in the case of any soil, it being understood that only a general, rather than a particular, importance is to be attached to any generalizations on chemical evidence given without special research.

The effects of the contour of the land, which seems to be disregarded frequently in cacao-planting, will be noted briefly in the case of each formation and type of sediment referred to.

In Mr. J. H. Hart's book on Cacao, and in the opinion of planters generally, the most favourable soil is said to be "loose clay, or clay with an admixture of a fair proportion of sand and lime."

Very many rocks in Trinidad are capable of yielding under disintegration soils coming under this somewhat comprehensive description.

The principal rocks that have been observed as forming cacao-bearing soils during the geological survey in 1904 are as follows:—

(1.) Alluvium (fluviatile and marine)	Recent.
(2.) Clays of the Tertiary Series	Kainozoic.
(3.) Marls ,, ,, ,, ...	
(4.) Sandy clays and alternations of sand and clay in the Tertiary Series	
(5.) Sandstones of the Tertiary Series ...	
(6.) Limestones ,, ,, ,, ...	
(7.) Shales and limestones of the Cretaceous formation ...	Mesozoic.
(8.) Metamorphic schists and limestone	? Palaeozoic.

(1.) The alluvium of the rivers, large and small, is made use of for planting in cacao to a great extent. It is evident that the alluvial soils must vary considerably in character and composition according to the rocks from the detritus of which they are formed. As a general rule the soil may be said to consist of fine sandy clay, the material being well mingled. The soil often appears much stiffer and less pervious than it is in reality owing to the fine particles of clay adhering to and concealing the coarser sand grains.

The advantage possessed by the alluvial expanses are that the ground is flat and easily worked, the material is well mingled, the situation is generally well sheltered, watered and convenient for trans-

port, and the soil often contains, especially when newly planted, a large proportion of humus or decayed vegetable matter.

The disadvantages are the occasional difficulty in draining, and liability to floods, owing to the flat nature of the ground, the frequent somewhat impervious character of the soil, and the fact that, as might be expected in material that has been thoroughly lixiviated, soluble bases, lime, alkalis, &c., have been largely or almost entirely removed.

It is clear that manuring with lime, basic slag or other chemical manures will supply material which is naturally deficient in such soils.

The alluvial flats of the Oropuche (E.) Sangre Grande, Cunapo and El Branche Rivers afford good instances of cacao estates established on alluvium, and the yield of cacao, I am informed, is good; the boundaries of the alluvial flats have been indicated on the maps of the Eastern district for this reason.

At Mayaro, Guayaguayare, along the main Southern Road and in the Northern range alluvial soils are planted with cacao also.

(2.) The Tertiary clays afford soils, which, though rich as regards chemical constituents, are seldom so suitable as regards mechanical condition for cacao growth. They are usually very stiff and impervious, requiring a great deal of draining when the land is level, and being liable to landslips on hilly or undulating ground.

These clays vary greatly in composition in different localities, some being gypseous, some calcareous and some containing bands of ferrous carbonate nodules. The Government Analyst, Professor Carmody, has recently discovered that a thin band of ferrous carbonate from one of the Tertiary clays contains 13 per cent. of phosphate of lime, which would form a very valuable addition to a soil formed from the disintegrated rock. If similar or even much smaller percentages of phosphate are present in the majority of the iron-carbonate nodules, the soil formed from the rock containing them should be the most valuable of the Tertiary clays for cacao planting. Another beneficial effect of the nodules is that their presence tends to loosen and lighten the heavy clay soil to some extent, while where they are present there is usually an appreciable quantity of lime present also.

The gypseous clays on the other hand are probably too stiff for the best results, forming a soil which is apt to be sour, though the solution of strings and laminæ of selenite, where it is present in large quantity, must enable the soil to drain more easily.

Forking round the trees and the addition of farm-yard or pen manure must evidently have a favourable effect on these soils by loosening them and supplying nitrogen, while chemical manures would probably be of less value owing to the abundance of bases naturally present in the disintegrated rock.

The Manzanilla district affords good instances of cacao grown on the blue clays containing iron-carbonate nodules and a proportion of lime. Instances of cacao estates on gypseous clays may be seen in Savana Grande.

The different varieties of clay have been noted and mapped, and the horizons richest in iron carbonate nodules are specially indicated on the maps.

(3.) The marls of the Tertiary Series from the well-known "black soils" of the cane plantations. They form excellent soils both from a chemical and mechanical point of view, the advantages they possess being a considerable percentage of lime and other bases, distinct porosity as compared with the clays, and the fact that they usually form undulating ground with many small hills and hummocks which are easily drained. The action of the lime is twofold; it seems to be requisite as a chemical constituent in all good cacao soils, and its solution and removal by percolating water tends to lighten and keep porous the soil which might otherwise be rather too heavy and impervious. Some of the best cacao in Trinidad is grown on these marls.

It is evident that to manure such soils with lime is merely a waste of labour, while forking round the trees may also be quite unnecessary, but basic slag supplying phosphate, and ammoniacal or farm-yard manure supplying nitrogenous compounds, may form valuable additions to the soil.

The outcrops of the marls have been mapped in every area traversed during the course of the geological survey.

Districts in Savana Grande, between Princes Town and Poole, afford instance of cacao estates on the marls.

(4.) At many horizons in the Tertiary series rapid and minute alternations of fine sands and clays are found. Such rocks on disintigration form soils which are admirable as regards mechanical condition, being neither too light nor too heavy, and draining readily. The clay supplies bases (lime, alkalis, etc.) while the sand renders the soil porous and supplies silica and a proportion of iron. Fossiliferous bands here and there may supply lime and phosphate in appreciable quantity, but the proportions of these as a rule will be much less than in the heavier soils. Between Manzanilla and the Cunapo and Sangre Grande rivers, especially in the northern part of the area indicated, bands of this nature are frequently observed, and on Mayaro bay areas of similar material are common, and good cacao is grown on them, but it has proved impossible to differentiate the outcrops during the mapping, though their occurrence in many places have been noted on the maps. Such strata have been coloured on the General one-inch map of the Eastern Coal-District as either sand or clay according to the predominating constituent.

Both basic slag and farmyard manure will probably be beneficial to soils formed from these rocks.

(5.) Where the beds of Tertiary sandstone crop out the soil is likely to prove too light for the best results, and accordingly we find very little cacao grown on sandstones. Some of the sandstones indeed are so pure that it would be impossible to grow cacao or bois immortel on them, but others with a calcareous cement, with an admixture with clay, or with fossiliferous shelly bands, furnish a soil, which, if light is still capable of growing cacao. Where there is an admixture with clay a soil admirable in mechanical condition may be formed, but it may be defficient in lime, alkalis, phosphates, etc. The great porosity is also a disadvantage: where the sandstones form

hills, as is very frequently the case with the more important beds, they are apt to drain too easily and become too dry in times of drought, while the soil is so light and friable that it washes away readily during the rainy season. In some estates considerable areas have been planted on sandstones and the cacao trees have grown very well at first, but the soil will become exhausted in a few years if manuring is not resorted to.

Almost any manure will enrich a light sandy soil, but lime and basic slag will probably prove the most effective.

East of Sangre Grande much of the cacao grown on the higher ground is in soil rather too light to give the best results without manuring.

All the main sandstone beds have been mapped in those parts of the island that have been surveyed geologically.

(6.) The Tertiary limestones form the best cacao land in Trinidad. The advantages they possess may be summed up as follows: they form fairly porous soils, but with sufficient bases for all the requirements of the trees, the percentage of lime is, of course, high, they occur in well marked and often steep ridges which drain well and easily and yield good supplies of water, and the rock disintegrates irregularly leaving blocks and masses amid a lighter friable soil, thus preserving the surface from being washed away and producing an ideal mechanical environment for the roots to spread in. Admixture with argillaceous or arenaceous material is usually appreciable, and by the solution of the lime carbonate this material becomes gradually concentrated on the surface, so the actual soil does not contain an excess of lime to the exclusion of other material of importance to the growth of cacao.

Manuring with lime is, of course, unnecessary, and forking round the trees should not be required, but basic slag and farmyard manure might be used with effect on many estates.

The best instances of cacao estates on the Tertiary limestones are in the Montserrat Hills, which are due to a great outcrop of the coralline and shelly limestone. Brigand Hill and Tamana are of the same material. Smaller and more compact limestones, occupying a higher horizon, have been mapped among the clays between the Cunapo and Sangre Grande rivers and in the Manzanilla district; they form sharp ridges covered with a somewhat argillaceous soil, and the cacao planted on them appears to flourish.

The carbonaceous rocks of the Tertiary Series do not cover sufficient areas to make their outcrops important as soil-forming rocks, but the presence of carbonaceous matter in bands of clay and sandstone must help in some cases to lighten the soil.

Outcrops of porcellanite, *i.e.*, clay burnt by the spontaneous combustion of underlying or intercalated bituminous or lignitic bands, have proved in some cases excellent places for growing cacao. The rock disintegrates into a rich heavy soil containing all the basic constituents of the unburnt clay, mingled with hard fragments of unaffected porcellanite, which keep the soil rubbly and prevent it from becoming too stiff and impervious. As the outcrops always form well marked ridges or hills, they drain freely. East of Sangre Grande there is a good instance of such an outcrop planted with cacao.

(7.) The Cretaceous rocks occupy wide expanses of surface about the Central range and near Pointe-à-Pierre. They consist of sandstones at the top and clays, shales and sandy shales with small limestone bands below; small outcrops of hard marl also appear here and there. The sandstones are very pure and siliceous giving light barren soils upon which cacao could not be grown profitably. The clays and shales on the other hand ought to provide excellent soil. They are harder and more distinctly bedded than the Tertiary clays, and as a general rule coarser in grain. Minute glistening flakes of clastic mica point to the presence of alkalis probably in greater quantity than in the Tertiary clays, while the presence of sandy material will render the soil more porous. The presence of thin bands of limestone and concretionary nodules of iron-carbonate indicate a diversity of composition which should be beneficial, and the soil formed by the disintegration of these rocks should contain nearly all the essential characters of a good cacao soil.

In the course of the geological survey very little of these clays and shales has been seen planted in cacao, but considerable areas of the highwoods near the Cunapo River and east of Tamana are formed of these rocks, and as the ground becomes opened up by roads it will probably be found that valuable cacao estates can be established in such districts.

(8.) Only small portions of the northern range have been traversed and full information about the soils has not been collected.

The soil and surface wash of the range varies considerably in composition and character according to the strata exposed. As a rule the soil is a red sandy clay containing fragments of undecomposed rock. The quantity of mica and talcose minerals in the rocks ensures a considerable proportion of alkalis and magnesia in the soil, while in the neighbourhood of the limestone outcrops, a fair percentage of lime should not be lacking. The ground is steep and hilly almost invariably, and so should drain easily.

Phosphatic and pen manures will probably have the greatest effect in increasing the yield of cacao on such soils.

The washed-down detritus of the range extends for some distance to the southward of the line of hills, but the nature of the soil does not vary greatly, though the more soluble constituents may be expected to have been removed to a greater extent from the material which has travelled farthest.

It seems to be generally admitted that the yield of cacao can be increased greatly by careful and judicious cultivation, but it is evident that different methods and different manures must be employed for different soils, if the best results are to be obtained. These notes are submitted in the hope that they may be of use to those interested in the cacao industry, as a guide in the forming of new, or the treatment of old established, estates, in so far as the development of the ground and the yield of cacao are determined by geological conditions.

[These notes were written at the end of Mr. Cunningham-Craig's first year's work in Trinidad, and he considers them only a preliminary excursion into the subjec Much additional information has since been collected.—Ed.]

707.—NOTES ON ORANGES AND OTHER FRUITS.

Many enquiries have been made recently on fruit-growing—especially on oranges, and the following answers to questions addressed to this office are submitted for general information :—

Question 1.—What are the best kinds of oranges to plant for export to England or America ?

Answer.—The best kind of oranges for general export should have the following qualities :—

(*a.*) Tough skin; (*b.*) Good distinct flavour; (*c.*) Good size and shape; (*d.*) Few or no seeds.

The following possess some or all of the above qualities : Jaffa, Navel, Pine-apple, St. Michael and Parson Brown.

Question 2.—Can plants be obtained at the Gardens and at what price per thousand ?

Answer.—Budded plants of the above varieties can be obtained at the Experiment Station nurseries, St. Clair at 24 cents each, but large quantities should be ordered about six months before they can be supplied.

Question 3.—What is the best kind for securing oranges with few seeds ?

Answer.—The variety with fewest or no seeds is "Navel."

Question 4.—Is any shade necessary for the cultivation of oranges ?

Answer.—No shade is necessary to grow oranges successfully, but they grow well and fruit freely where protected from wind and in some places where they are shaded as on Cacao Estates.

Question 5.—Can Citron plants and other fruit trees be had at the Gardens, and at what price ?

Answer.—Plants of Citron and other fruit can be had at the nurseries, St. Clair at the following prices :—

	$ c.
Oranges :	
Budded plants	24 each.
Seedling	3 ,,
Limes :	
Budded plants (seedless and spineless)	24 ,,
Seedling ,, ...	3 ,,
Citron	5 ,,
Shaddock	5 ,,
Grape-Fruit	5 ,,
Guavas :	
Large mèlon-shaped	10 ,,
Mangos :	
Finest varieties grafted plants	1 00 ,,
,, ,, seedlings	10 ,,
Lit-chi (*Nephelium Lit-chi*)	10 ,,
Pomme-malac (*Eugenia malaccensis*)	5 ,,
Belle-Apple (*Passiflora laurifolia*)	5 ,,
Grandadilla (*Passiflora macrocarpa*)	5 ,,
Mamme-Apple (*Mammea americana*)	5 ,,
Sugar-Apple (*Anona squamosa*)	5 ,,
Custard Apple (*Anona reticulata*)	5 ,,

	$ c.
Sour-Sop (*Anona muricata*)	5 each.
Carambola (*Averrhoa carambola*)	5 ,,
Sapodilla (*Achras sapota*)	5 ,,
Sapote (*Lucuma mammosa*)	10 ,,
Mabola (*Diospyros mabola*)	5 ,,
Golden Apple ((*Spondias dulcis*)	5 ,,
Hog Plum (*S. graveolens*)	5 ,,
Star Apple (*Chrysophyllum Cainito*)	5 ,,
Cashew (*Anacardium occidentale*)	5 ,,
Barbados Cherry (*Malpighia glabra*)	5 ,,
Avocado Pear (*Persea gratissima*)	5 ,,
Bread Fruit (*Artocarpus incisa*)	60 ,,
Bread Nut (*A.* ,, ,,)	5 ,,
Akee (*Bligbia sapida*)	5 ,,
Rose Apple (*Eugenia jambos*)	5 ,,
Governor Plum (*Flacourtia Ramontchii*)	5 ,,
Genip (*Melicocca bijuja*)	5 ,,

Question 6.—Can orange trees grown from slips or cuttings be had at the Gardens and at what price per thousand ?

Answer.—Raising orange trees from "slips" or cuttings is an unreliable method of propagation and is seldom practised. Budding or grafting desirable sweet varieties on sour orange stocks is much the best method, the stock being hardy and resisting Mal-di-goma and other such diseases. Orange trees grown from cuttings (even if they could be so propagated in large numbers) would probably be readily attacked by those diseases.

Question 7.—Do trees grown from "slips" take longer to bear than those from seeds ?

Answer.—The fruiting of orange trees from cuttings has not been observed by us, but from what we know of the growth of other fruit trees under similar circumstances and from the laws of plant physiology we would say those grown from cuttings would probably fruit sooner than those from seeds. They usually fruit sooner by being budded or grafted.

Question 8.—What distance apart are orange trees usually planted ?

Answer.—The distance apart to plant orange trees would vary, as with nearly all trees, according to soil, situation and the grower's requirements. Orange trees may be planted from 15 to 25 feet apart.

N.B.—A very useful pamphlet has recently been issued by the Imperial Commissioner of Agriculture, Barbados, on "Cultivation of Oranges at Dominica" with an Appendix on the Jamaica Orange Industry. The notes on Oranges at Dominica were written by His Honour H. Hesketh Bell, C.M.G., Administrator, there. The pamphlet may be obtained from Messrs. Muir, Marshall & Co., Port-of-Spain, price four-pence.

708.—INTRODUCTION OF CACAO FROM VENEZUELA.

On the 8th of May, a consignment of four cases of cacao pods were received at the Experiment Station, St. Clair, from the British Vice-Consul—Puerto Cabello.

On the suggestion of Mr. J. D. Sellier of Port-of-Spain, His Excellency the Governor Sir Henry Moore Jackson, K.C.M.G.,

directed the Superintendent of the Botanical Department to write for these.

Three of the cases contained pods from Borburata district the other case contained some from Miquija estate. The latter pods had rotted a good deal and a large number of the seeds did not germinate, but those from Borburata proved much better, nearly all having germinated. All the seeds were sown in the nurseries at St. Clair and plants are now growing.

The pods and beans were of a good size and quality and it is hoped that they will prove to be distinct acquisitions to the cacao planters of the colony.

An additional consignment from Miquija estate is to be asked for on account of so many of the previous lot not germinating.

709.—PRIZES FOR COTTON.

At a meeting of the Cotton Committee held on the 2nd May, 1905, prizes were awarded in accordance with instructions issued by His Excellency the Acting Governor on the 7th July, 1904, as follows:—

A.—For best two acre plot of Sea Island Cotton (two entries)—

1st prize—G. Trestrail, Mon Jaloux	... ...	£10
2nd ,, G. Wyatt, Princestown	... ...	6

B.—For best one acre plot (six entries)—

1st prize—G. Trestrail, Mon Jaloux	... ...	£ 5
2nd ,, T. Sirju, Oropuche	... ...	3
3rd ,, Boodsing, Guapo	... ...	2

C.—For best sample ginned Sea Island Cotton (four entries)—

G. Trestrail, Mon Jaloux ...	... ...	£ 5

Owing to there being only two entries for Section A, the third prize was withdrawn.

710.—PARASITES IN CATTLE AND POULTRY IN TRINIDAD.

By C. W. Meaden, Manager, Government Farm.

Owing to an outbreak of parasitic disease at the Farm a collection of the different varieties was made as they were discovered with a view of obtaining some knowledge of their origin and action. This collection with such observations as could be given were forwarded to Sir D. Morris, K.C.M.G., who sent them on to the Agricultural Department, Washington, United States, for examination and identification.

Dr. D. E. Salmon of that department has written in reply remarking on each specimen as numbered. A copy of this letter follows with the observations sent at the time with the specimens.

WASHINGTON,

February 18, 1905.

DEAR SIR,—Replying to your letter of January 27, forwarding specimens of animal parasites, would say that we are unable to pass any opinion on specimen No. 1. No. 2 are dipterous larvæ no doubt deposited by some fly after the death of the fowl. No. 3 contains 2 species of nematode worms.

Trichosoma sp. and *Heterakis papillosa*, and a tape worm, *Davainea echin obo thrida*. No. 4 are specimens of *Heterakis perspicillum*. No. 5 contains specimens of *Strongylus Micrurus* which occurs in the lungs of cattle and specimens of *Trichuris affinis* which occurs in the caecum.

The life history of none of these parasites is well-known. In the case of *Heterakis papillosa* and *perspicillum*, however, there seems to be direct development, that is, the eggs deposited by the worms pass out of the fowl's intestines and when the embryonic worms either before or after hatching are swallowed with the food or water by other fowls, the worms mature in the latter. In the case of the tape worm there is undoubtedly an intermediate host such as an insect, snail, or other small invertebrate.

A number of publications on the question of parasites are being forwarded under separate cover.

I am, etc.,

(Sgd.) D. E. SALMON.

Sir DANIEL MORRIS, K.C.M.G.

POULTRY.

REMARKS SENT WITH SPECIMENS.

1. Specimen. scaled off the liver of a fowl which had died from unknown cause, no visible symptoms appearing.

2. Specimens. These were found located on liver and gizzard, in nest form, closely packed together, very active when disturbed. Placed in pure alcohol did not affect them, 50 per cent. of creosote added, they lived 20 minutes, showing how difficult it would be to reach them by treatment.

3. Specimen. Taken from same fowl found in intestines. The bird was under observation and voided these worms naturally, was treated with turpentine, creosote and oil, died. Examination showed large numbers located in intestines.

4. Specimen. Found in intestines, not very numerous, fowl very anæmic, due it is thought to the attack of these worms.

The victims were imported White Wyandottes, supplied from the Government Farm, Nova Scotia, bought when quite young chickens. The question arises whether they came to us infected or whether the parasite attacked them here.

So far as I can say our ordinary Creole poultry have never exhibited similar symptoms. I have had thousands of poultry killed,

not only of our local fowls but from most of the other West Indian islands.

The loss amongst these imported fowls was equal to 30 per cent., but lately this has ceased. The poultry are carefully kept on grass and gravel runs, which are dressed with hot lime, good sound food and pure water is supplied.

CATTLE.

5. Specimen. Strongylus sp. which proved most destructive to the Farm cattle last year, both old and young. These parasites were located in the lungs, which induced pneumonia followed by emaciation, diarrhœa, death. The water supply at the time was contaminated with sewage and since a new supply has been provided there has been no further attack or loss.

Any information regarding the life history of these parasites will be most acceptable.

C. W. MEADEN,

Government Farm, Manager.

18th January, 1905.

FURTHER REMARKS.

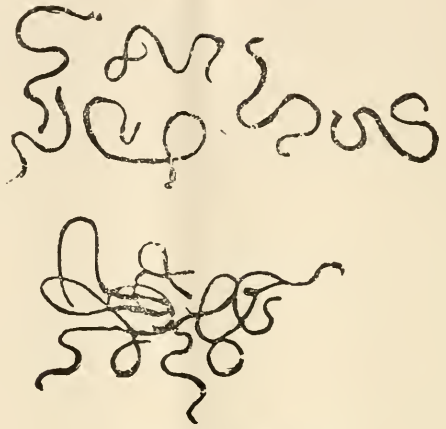
These further remarks on the subject are not touched upon from purely scientific diagnosis, but from the practical aspect which the owner of stock is likely to encounter in his every-day management. The matter is dealt with from the conditions of Trinidad; which, though not a pastoral country, raises a fair number of stock; and, apart from parasitic attacks, their health and growth is satisfactory, and diseases scheduled as contagious are practically unknown.

Our chief source of trouble and loss in cattle on the Government Farm was due to a species of *Strongylus*, which has been identified from the specimens sent as *Strongylus micrurus*. This parasite attacks the bronchial passage and the lungs. Another variety, *filaria*, attacks the intestines. These two are the root of the greater part of the suffering and loss in our cattle, sheep, pigs and goats.

The first and most serious parasite from which the Farm suffered so grievously was the *Strongylus m.*, the attack being acutely virulent from July to December, 1902–3. Within that period nearly one hundred animals, old and young, were lost. There were three predisposing causes for the attack—first, opening new land from scrub and bush which had never carried cattle before; secondly, innutritious and insufficient grass; and thirdly, impure water. This last, no doubt, was the prime factor in the attack, as this particular parasite finds its breeding abode in contaminated water. Proof of this is abundant, for when the polluted water was shut off and a pure supply given the attack disappeared magically, the health and growth improved at once, without additional cost or attention.

The rough sketch of the parasite attached shows its form, which is about $1\frac{1}{2}$–2 inches long, similar to short pieces of white cotton thread. It has an active eel-like movement when disturbed, but

embedded in the lungs, where they collect in masses, protect themselves by a mucous covering, which greatly retards treatment for their destruction.



"STRONGYLUS MICRURUS."

Symptoms of the Disease.—In the early stages little is observed but a cough; this becomes particularly harsh and hollow, which is more pronounced when the sufferer is driven or startled. There is usually a flabby swelling under the jaw; this is a sure indication of the parasite. The coat is staring, and the hair drops off in patches. The cough becomes worse and the animal gradually weaker until unable to stand. It lies out full length with the neck outstretched, and breathing more difficult and distressed; this continues until death ensues from exhaustion and suffocation. Examination after death will show large quantities of the worms in the throat and lungs.

Treatment for Cattle.—As soon as symptoms of parasitic disease is observed, the principal form of treatment should be—first, to support the animal's strength by a liberal allowance of good food that is easily assimilated, plenty of salt, pure water, and, if possible, a change of pasture. For the treatment of the destruction of the parasite, hypodermic injection into the bronchial passage is immediately destructive of all located there, but this should be carried out by practised hands, as death may occur very rapidly after the injection by the mass of parasites in the passage collecting at the junction with the lungs and thus causing suffocation. Continued doses of carbolic acid in the food is, no doubt, the best and surest remedy, the antiseptic action entering into the circulation and thus to the lungs and so proving fatal to the parasite; though somewhat slow, the results were undoubtedly successful.

A useful and simple drench as a preventative on suspected pastures and localities is equal parts of Stockholm tar and sale with sufficient oil to make it liquid—dose according to age.

Parasite in Sheep.—This short description concerning sheep is confined to *Valsayn* land and to one parasite, though others were seen, tape worms, &c., The land is sandy loam with a gravel substratum, but lays too low for successful sheep-rearing under the best conditions.

It is exposed to the North wind, which comes directly on to the place from the Maracas valley; on the South the Caroni river overflows its banks, leaving malarious swamps, and from the East the storm water flows over the land on its way to the West and the sea. In a bad season stock must encounter many unpleasant hours. For sheep-rearing such a locality should not be selected.

With regard to the parasite which inflicted loss on the flock it is described as *Strongylus filaria*. This form inhabits the intestines generally, but more particularly in the delicate portions. The *filaria* is a fine thread worm about half an inch long, of a dirty red colour; they lay together in masses attached to the membrane, which becomes inflamed and destroyed. Death appears to occur from diarrhœa and exhaustion, the sheep being greatly emaciated.

Various remedies were tried without much success. A mixture of tar, salt and santonine certainly destroyed the parasite but the sheep that recovered were left anæmic and never improved, and were finally disposed of on the premises.

Experiment was also made with sheep bought in Tobago. These were of the usual diminutive type; they were located in an enclosed space which had never carried cattle of any description and given oats and corn, in addition to good grass and rain water. After some days two began to show the usual signs of distress—arched backs, diarrhœa, not feeding, &c. One was given the medicine mentioned, the other nothing; both died emaciated as if starved; both were badly infested with *filaria*. From the treatment adopted there is evidence that Tobago sheep suffer from this parasite considerably, and this would account to a great extent for their diminutive size and want of development. The sheep on the Tobago branch of the Farm suffered somewhat extensively at first from this form of disease, but improvement took place when the flock was moved to new ground and given water from a new supply without the aid of medicine.

I also observed this form of disease in sheep in some parts of Canada, showing how widely this pest is distributed.

Pigs.—Fortunately the pigs of the Farm escaped injury, which may be attributed to the fact that they are kept clean in concrete styes, with plenty of bedding. The water given is pure, and their food cooked with a plentiful supply of fresh grass. They are given exercise, but not allowed to wander at their own sweet will.

Though we have been fortunate to escape disease amongst pigs on the Farm, it is very evident, from the number of pigs which are slaughtered whose lungs are condemned as unfit for food, that they contribute their share to the destroyer. As the pig is generally treated as a scavenger, he must, if suffering from parasites, in his wanderings spread the disease broadcast, and if he can reach water used by other animals, then the chances are that the evil is greatly increased.

The medicine mentioned above is an allround useful vermifuge, and would be as good for pigs as other animals. The way to administer it is to tie a rope round the lower jaw, cut the toe off an old shoe, put it into the pig's mouth, and pour down the physic. This is the easiest and surest way of getting it into the patient.

Poultry.--Poultry enters so largely into our dietary that any knowledge that can be gained to prevent loss should prove most acceptable. The prevalent diseases are parasitic, generally run a specific course, and treatment has no great influence. The ailments are generally outward and visible—such as yaws, roup, worm in the eye, ticks, lice, and so forth, quite enough to give both the fowls and their owners a bad time.

But the specimens sent for identification appear to be new and their life history obscure. I have never seen their like in the many hundreds of poultry which have passed through my hands.

Dr. Salmon's remarks on specimens 3 and 4 describe how far the history of these particular parasites has been discovered. Three distinct specimens were found in one fowl, and one entirely different in another. This is confusing.

Symptoms.—The birds were imported. White Wyandottes, about three months on the Farm—several head were seen to be ailing, but showed no outward indications except dullness and the droopy appearance of ailing poultry; temperature slightly above normal.

Treatment.—Tonics were given at first without effect, and the dead ones showed only a starved condition. Suspecting worms, a mixture of turpentine, creosote and oil was given, also Jeyes' fluid in olive oil; both were effectual in bringing away the worms described in the remarks; both fowls died. The treatment was applied to the remainder, and no further loss has occurred; probably they were less infected than those lost.

In conclusion, very little is known of the history of our animal parasitic life. They are widely spread, and are responsible for the greater portion of loss amongst stock generally in Trinidad.

It is hoped that in offering this paper something has been contributed towards a knowledge of the subject. It is very imperfect, but may perhaps be of some help and guidance in fixing upon the cause of disease, especially in cattle.

711.—AGRICULTURAL COURSE, 1905-6.

PORT-OF-SPAIN AND SAN FERNANDO TRAINING SCHOOLS, AS APPROVED BY LT.-COLONEL J. H. COLLENS, V.D., INSPECTOR OF SCHOOLS.

First Stage—Elementary.

No.	Subject.	Date. Port-of-Spain.	San Fernando.
I.	The making of a shed and boxes for growing seedlings	...May 15	...May 6
II.	Preparation of soil for sowing seeds, &c. ...	... ,, 22	... ,, 13
III.	Seeds and how they grow. Sowing seeds in boxes	... ,, 29	... ,, 20
IV.	Dibbling or transplanting seedlings	...June 5	... ,, 27
V.	Propagations by cuttings and division	... ,, 19	...June 3
VI.	Roots and how they grow ...	... ,, 26	... ,, 10
VII.	Formation of a school garden ...	.. July 3	... ,, 17
VIII.	Maintenance of a compost heap ...	... ,, 10	... ,, 24
IX.	Preparation of vegetable beds ...	... ,, 17	...July 1
X.	Sowing of seeds in the open ground	... ,, 24	... ,, 8
XI.	Digging and general tillage ...	... ,, 31	... ,, 15
XII.	Summary	...Aug. 7	... ,, 22

Second Stage—Advanced.

I.	Sowing seeds of special kinds ...	...Sept.	18	...Sept.	23
II.	Thinning and hardening of seedlings	... ,,	25	... ,,	30
III.	Natural distribution and construction of seeds	...Oct.	2	...Oct.	7
IV.	Construction and functions of leaves	... ,,	9	... ,,	14
V.	Construction and functions of stems	... ,,	16	... ,,	21
VI.	Principles of pruning... ...	... ,,	23	... ,,	28
VII.	Propagation by leaves and layering	... ,,	30	...Nov.	4
VIII.	Propagation by budding and grafting	.. Nov.	6	... ,,	11
IX.	Manures and how to apply them	... ,,	13	... ,,	18
X.	Weeds and weeding	... ,,	20	... ,,	25
XI.	Summary	... ,,	27	...Dec.	2

Third Stage—Special.

I.	Construction and functions of flowers	...Jan.	22	...Jan.	20
II.	Propagation by seeds *versus* propagation by other means	... ,,	29	... ,,	27
III.	Fruits—how to pick and pack them	...Feb.	5	...Feb	3
IV.	The cotton plant—its construction and cultivation	... ,,	12	... ,,	10
V.	Transplanting young trees; the Cocoa tree —its construction and cultivation ..	,,	19	... ,,	17
VI.	Advanced study of manures ...	... ,,	26	.. ,,	24
VII.	Decorative plants—how to arrange and cultivate them	...Mar.	5	...Mar.	3
VIII.	Advanced study of pruning and wound hygiene	... ,,	12	... ,,	10
IX.	Plant diseases- Fungi ...	... ,,	19	... ,,	17
X.	Plant pests—Insects	.. ,,	26	... ,,	24
XI.	General notes and summary ...	...April	2	.. April	31

Arrangements have been made with the Head of the Agricultural Department for these lectures to be given as nearly as possible on the dates indicated by one of the Agricultural Instructors, in Port-of-Spain at the Government Training School, and in San Fernando at the Canadian Mission Training School. An examination will be held at the end of the Annual Course.

712.—CACAO DRIER AND LIMEPLANT.

SHORT DESCRIPTION OF HOADLEY'S COCOA DRIER AND LIME PLANT, ON ST. CHARLES ESTATE, CHAGUANAS.

The cocoa drying apparatus consists of an ordinary room 34 feet square, with 25 feet perforated circular drying floor, upon which cocoa is placed direct from the fermenting box. In the centre of the drying tray is a vertical axle from which project 4 arms, which are revolved once in 10 minutes. To each arm is attached 6 plows, the operations of which are equal to the work of 12 coolies in keeping the cocoa in constant motion. Hot air is generated by exhaust steam, which is passed into 1,100 feet of piping enclosed in a box, over which cold air is drawn by a powerful fan which makes from 600 to 700 revolutions per minute. The air in its passage becomes heated to any desired point up to 150 deg., and is forced up through the drying floor. The machine will dry from 12 to 15 bags of cocoa in 30 to 36 hours.

After drying, the cocoa is passed through a machine which clays and polishes, or merely polishes to suit the markets, and thereby saves the costly process of dancing.

The cocoa is fermented in cylindrical drums, which are partially turned every night and morning for 10 to 11 days.

The Lime Plant consists of a 3 wood roller mill, a 250 gallon steam still, and 3 wood concentrating tubs, operated by steam coils. The tubs have not proved very satisfactory owing to the impossibility of preventing leakage. A very good class of juice has been made, bringing £14 per pipe of 64 oz. citric acid to gallons juice shipped contained 113 oz. citric acid.

713.—PLANTS IN FLOWER OR FRUIT.

The following species are noteworthy :—

Lilium philippinense.—Six bulbs of this Lily were received from the American Department of Horticulture in the Philippines in May last and all have grown well. One plant growing in a border at St. Clair has a flower bud about to open.

Nephelium Litchi.—This species was noted and described in our bulletin for July last year. It has again produced a good number of its delicious fruits this year in May.

Garcinia mangostana.—Our old Mangosteen tree is now bearing a large number of flowers and a good crop of this most delicious East Indian fruit is expected in October.

Caryocar nuciferum.—A young tree of this—the Souari or Butter Nut of British Guiana is now bearing fruit at Government House Gardens.

Leptactina Manni.—This beautiful Rubiaceous shrub flowered freely at St. Clair recently. The plant was received from the Royal Gardens, Kew in August, 1900. It is a valuable acquisition to our collection of flowering shrubs, has the habit of a coffee plant but grows well in the open exposed to the sun. It forms quite a spectacle with its large white star-shaped flowers which are produced in such profusion as almost to hide the leaves.

We have found it a little difficult to propagate. It has hitherto produced no seeds and cuttings do not root readily. It is a native of Tropical Africa.

Mesua ferrea.—An old tree of this species is growing at Government House Gardens. It is about 35 feet high and is of a fine symmetrical conic form. It flowered in May this year. The flowers are pure white, about three inches in diameter, and somewhat resemble a single white rose. The beauty of the flowers is enhanced by the deep green colour of the foliage. It has hitherto produced no seeds and is difficult to grow from cuttings.

714.—'THE AGRICULTURAL NEWS.'

A FORTNIGHTLY REVIEW OF THE IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

Through the kindness of Sir Daniel Morris, K.C.M.G., Imperial Commissioner of Agriculture for the West Indies, one hundred sample copies of the 'Agricultural News' have been granted for free distribution in this colony.

The Agricultural Instructors in their travels about the Island have had inquiries from planters and others regarding some useful periodical on tropical agriculture and the 'Agricultural News' has been recommended as the best paper of the kind issued in the western tropics.

The above-mentioned sample copies will therefore be distributed first to those enquirers, and the remainder will be available for any one in the Colony who applies to the Superintendent Botanical Department, Port-of-Spain.

For the benefit of those in the colony who may not have heard of this periodical we give the following extract:—

The 'Agricultural News' contains extracts from official correspondence and from progress and other reports; and, in fact, any information indicating what is going on in each colony and the progress made in Agricultural matters throughout the West Indies.

The 'Agricultural News' is printed in time to be distributed, regularly, by each mail, and is on sale by the local agents of the Department at one penny per number, post free, $1\frac{1}{2}d.$ The subscription price, including postage, is 1*s.* $7\frac{1}{2}d.$ per half-year, or 3*s* 3*d.* per annum. Vols. I, II and III complete with title page and index as issued– Price 4*s.* Post free, 5*s.* Only a few copies available. *All applications for copies are to be addressed to the Agents, not to the Department.*—Agents—Trinidad: Messrs. Muir, Marshall & Company, Port-of-Spain. Agent—Tobago: Mr. C. L. Plagemann, Scarborough.

715.—NOTES AND EXTRACTS ABOUT RUBBER.

Some washed "cultivated" Rubber has been sold at the record price of 6*s.* $8\frac{1}{2}$d. per lb.—(*India Rubber Journal*, 22nd May, 1905).

The average price for Fine Para Rubber during the last three years has varied as follows:—

	s.	d.
1903—average price per lb.	4	0
1904 ,, ,, ,, ...	4	8
1905 ,, ,, ,, ...	5	6

The market shows no tendency to decline and there is certainly no hope in the immediate future of a rapid fall in price.—(*India Rubber Journal*, 22nd May, 1905).

Some new uses for Rubber:—

(1) instead of sheepskin for bag-pipes;

(2) for covering the stone-work round the sides of public swimming baths.—(*India Rubber Journal*, 22nd May, 1905).

Some increasing uses for Rubber :—

(1) tyres for vehicles ;
(2) shoes and other foot-wear ;
(3) telephone and telegraph cables :
(4) electric appliances generally ;
(5) rubber belting and machinery.

The present high prices for Rubber may be accounted for by

(1) the increasing demand ;
(2) improved preparation of raw material.

Rubber latex or milk—to produce the finest grades, is now carefully collected, washed and coagulated, and the Rubber is sent to the market in the form of thin sheets or "biscuits." In this form, the presence of dirt or any foreign matter would be easily detected by the buyer, and when quite clean the rubber can be worked up by the manufacturer with much less trouble and expense.

Plantations of *Castilloa elastica*, *Hevea brasiliensis*, and *Funtumia elastica* have been established in Trinidad. The following extracts are taken from reports of the Senior Agricultural Instructor :—

"In Mayaro Ward, two small plantations of *Castilloa elastica*—of about ten acres each, were examined. Both plantations were on undulating land, naturally well-drained. The first had been formed by cutting out the majority of the trees from the virgin forest and clearings made in the under-bush about five feet wide, and along the centre of each clearing the Castilloa were planted at about twelve feet apart. In the second plantation, the whole of the original trees and bush had been cut down and temporary shade, such as Bananas and Cassava had been planted to protect the young Castilloa plants, (Practically the same method as is generally adopted for the formation of a cacao plantation—Ed.) The trees in the latter plantation were much stronger and healthier—quite as tall but not so spindly, and there were fewer blanks and weak plants than in the former plantation. Near here was pointed a place where a few Funtumia had been planted but all had died. (Probably due to exposure to sun just after planting, or putting in plants without removing bamboo pots—Ed.) A plantation of Hevea was then visited near the bank of the Ortoire river. The young Hevea trees had been planted under the large trees—chiefly *Mora*, of the virgin forest, all the smaller trees and bush being previously cut down. There were only a few Hevea trees to be seen. A large majority had died and even those remaining were very weak. I was told that owing to an oversight the plants had been put in the soil without removing the bamboo pots in which they had come from the nursery. Further up the river and also under the forest shade some Landolphia rubber plants were growing well, climbing up the trunks of the largest trees."

"At Chaguaramas and Gasparee there are several trees of Ceara (*Manihot Glaziovii*) growing well. At San Diego, several Castilloa trees are thriving amongst the cacao. In Brasso Caparo district there are several plantations of Castilloa about four years old, and at Coco-

loco about four acres have been cleared for planting Funtumia (Lagos Silk Rubber), and at another place on this estate, the Funtumia has been planted about five months and is growing well under the natural shade of the forest. One thousand seeds of Funtumia had been sown in boxes but none had germinated owing chiefly to using improper soil. (About 70 per cent. horse droppings—Ed.) At St. Marie estate there is an extensive nursery where about 10,000 plants of Funtumia and cocoa are being grown in bamboo pots. There are also sheds for potting and growing seedlings in boxes. Several thousands of rubber seeds had been lost owing apparently to boxes being insufficiently drained. On this estate several acres were already occupied by healthy Funtumia trees planted twelve by twelve (feet—Ed.) Traces about four feet wide had been cleared in the forest and all the largest trees had been cut down, leaving only a scattering of medium-sized trees which were intended to be removed later when Funtumia were strong enough to grow without their shade or protection. The Funtumia were growing in the centre of the traces or clearings."

"The young Funtumia in the wild forest land (St. Marie Estate) are growing well. There were very few deaths during the long spell of dry weather in October and November last year."

"At Monte Christo there are about 20,000 rubber trees growing. They are mostly *Castilloa elastica*, one to eight years old, and planted under the forest shade. Some of the oldest trees were tapped this year (1903) but the rubber was of an inferior quality and a very small amount was obtained. There are also some Para Rubber (*Hevea brasiliensis*) and Lagos Silk (*Funtumia elastica*) growing well in an open situation near the edge of the forest."

N.B.—Mr. J. H. Hart, F.L.S., Superintendent, is in England on leave of absence as Commissioner representing Trinidad at the Colonial and Indian Exhibition, Crystal Palace. This number of the bulletin has therefore been edited by the undersigned.

WILLIAM LESLIE,
Acting Superintendent.
(Previously Senior Agricultural Instructor).

BOTANICAL DEPARTMENT.

BULLETIN
OF
Miscellaneous Information.

(QUARTERLY.)

OCTOBER, 1905.

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EDITED BY

J. H. HART, F.L.S.,

Superintendent, Botanical Department.

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716.—CACAO EXPERIMENT PLOT.

A STATEMENT of the results of work on this plot was given in last issue of Departmental Bulletin, published during Superintendent's absence in London.

I find the statement there made was compiled from insufficient information, and therefore must be cancelled.*

In consultation with the Hon'ble Mr. de Verteuil, I found him strongly of the opinion that results of the experiments should be given for the period generally recognised as the Cacao year—viz., from 1st July to 30th June of succeeding year.

I am in full accord with this view, as the experiments cannot be fairly considered to have commenced until the end of June, 1904, although an earlier period was taken in the statement referred to above.

Mr. de Verteuil has kindly furnished me with the figures used in following table as the results for the year ending 30th June, 1905 :—

Result of Cacao Experiment Plots at La Vega Estate, Brasso, Hon'ble Carl de Verteuil.—July, 1904, to 30th June, 1905.

Number of full bearing trees.	Manuring Treatment. Per Plot.	Lbs. per tree.	Expenses. Cost of Manures.	Cost of Cultivation.	Total.	Yield Lbs. Wet Cacao Harvested. Plot.	Per tree.
		1.	2.	3. $ c.	4. $ c.	lbs.	
* A 235 ...	... ...	...	...	11 59	11 59	1,860	7·91
* B 215	Sulph. of Ammonia—400 lbs.	1·86	18 72	15 64	34 36	1,896	8·82
	Basic Slag—4 cwt. ...	2·08					
* C 224 ...	Pen Manure—10 tons ...	100	4 80	18 88	23 68	1,990	8·88
* D 216	Basic Slag—4 cwt. ...	2·07	8 08	15 64	23 72	2,332	10·79
	Sulphate of Potash—1 cwt....	·51					

* Plots A. B. C. and D. contain approximately one acre.

As I am unable to satisfy myself that it is wise to attempt to draw any conclusions from the results of a single year, I have omitted reference to the comparative money value of results. Such results are for the present sufficiently plain in the increased yield of "wet cacao" without reducing it to "dry cacao," which could only result in introducing another comparison based upon an insufficiently ascertained value. The amount of dry cacao, for instance, could only be *estimated*, and the variation in such estimate would seriously affect the returns of the experiment. It is considered better, therefore, to use "wet cacao" instead of dry cacao as a basis of calculation from the fact that it excludes all loss in preparation and form a better basis

* See *Bulletin*, No. 47.

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for comparison. It is however intended to carry out a series of trials (already started) at *River* estate by which it may be ascertained what is really the average weight. when dry, of 100 lbs. of wet cacao.

Deductions made from experiments which extend over short periods only, are apt to mislead, rather than to inform ; as the results of one year may not compare with the next, although each has its value in the aggregate taken from the results of several years. It is proposed therefore to await the returns from such plots, until at least three years has elapsed, when the value of the experiment will be more plainly seen.

An opinion may however be recorded without prejudice. Mr. De Verteuil writes :—" *Next year I think will show up better, as the trees have certainly a healthier look on the manured plots than on the unmanured one.*"

Such an opinion is of value as coming from an experienced planter, and one accustomed and fully competent to judge the condition of a cacao tree.

717.—THE GROWTH OF PLANTS WITHOUT CARBONIC DIOXIDE.

M. Lefèvre has recently contributed a paper to the Académie des Sciences upon the development of plants exposed to light but entirely deprived of Carbonic dioxide in an artificial soil containing amides (crystalizable substances allied to ammonia but containing less water). He begins by observing that the carbonic acid of the atmosphere is not the only source whence green plants may derive their carbon. By a series of experiments. M. Lefèvre *proved* that in soil containing a suitable quantity of amides green plants could be developed though deprived entirely of carbonic acid gas. The plants increased to five or even ten times their height multiplied their leaves, and the tissues were formed normally. When both carbonic acid and amides were absent the growth was arrested. Therefore growth under a glass in soil containing amides is affected by a process of nutrition.— Extract " Gard. Chron."

2nd September, 1905.

718.—MANGE IN CATTLE.

DEFINITION.

Mange is a contagious skin disease caused by parasites belonging to the class of psoric acari.

Three forms of mange occur in cattle, viz., *sarcoptic, psoroptic,* and *symbiotic.* These forms are named after the variety of parasite which is the cause of the ailment. Sarcoptic mange in cattle is uncommon. The most prevalent forms are the psoroptic and symbiotic, and these frequently exist together in the same animal. Cows are most often attacked.

SYMPTOMS.

The most common sites of mange are the root of the tail and neck especially the former. The psoroptic form may spread all over the body if treatment is neglected, but usually it does not. The biting of the parasites gives rise to an itchy condition of the skin, which causes the animal to rub itself against fixed objects, with the result that the hair over the effected part gets rubbed off. On examining the skin a considerable amount of scurf may be seen. Red and yellow blood scabs appear on the surface, and there may even be abrasions if the animal has been rubbing against rough objects. If the psoroptic form should spread over the body the patient may waste away and become greatly reduced in condition. In cases of this kind, however, it will often be found that the wasting is due to some serious internal trouble such as tuberculosis, which reduces the animal's natural power of resistance to the less serious disease.

It has not infrequently been observed that cows appear to become cured spontaneously when turned out to grass in the spring. This usually means, however, that under open air conditions the parasites do not increase at the same rate, hence the active symptoms are merely less marked. When the animals are again stabled in the autumn the acari (parasites) which have persisted resume their activity, and this sometimes leads to an erroneous belief that re-infection has taken place.

PREVENTION.

(1.) The affected patches on the animal's skin should be softened by washing with soap and warm water. After this has been done the parts should be dressed with one of the common mange dressings, such as spirit of tar, oil, and sulphur. The dressing should be applied twice or even three times at intervals of ten days. For the serious and rebellious cases above mentioned veterinary advice thould be sought.

(2.) The litter from an infected animal should be removed each time after dressing, and the flooring and wood or other fittings should be well sprayed with a five per cent. solution of carbolic acid in water. —Leaflet No. 13, *Board of Agriculture and Fisheries*, 4, Whitehall Place, London, S.W. April, 1905.

719.—A WHITE BAT.

DURING the month of July 1905, a large White Bat was seen by several persons flitting about the Gardens near Government House. Whether this is a true *albino* or only a form of one of the ordinary types remains to be seen, but the occurrence is put on record as somewhat unusual if not rare.

720.—TESTS FOR FARMERS' MILK.

THE following leaflet issued by the English Board of Agriculture and Fisheries appears to be a move in the right direction as it affords

the Farmer an opportunity of testing the value of his milk for the nominal sum of sixpence a sample :—

TESTS FOR FARMERS' MILK.

"It is a well known fact that in the vast majority of cases the milk given by the cows of this country exceeds in butter-fat and other milk solids the percentage specified in the "Sale of Milk Regulations, 1901," made by the Board of Agriculture. It happens, however, occasionally, that for one reason or another a cow may give milk which does not contain those percentages (3 per cent. of butter-fat and 8·5 per cent. of other milk solids) ; and in such cases the dairyman, when prosecuted, is required to prove that the milk is genuine. In order to avoid the trouble and annoyance of a prosecution, farmers, dairymen, and all other cowkeepers are strongly recommended to have samples of the milk of their cows tested from time to time. By this means they will be able to watch the seasonal and other variations in the fat contents of the milk, and by modifications in the feeding, housing, or time of milking of their cows, and, if necessary, by disposing of animals that give milk of low quality, to keep the quality of their milk at a satisfactory level.

"The Board have ascertained that, with the object of assisting farmers in the direction indicated, most of the Agricultural Colleges and Agricultural Departments of the Universities have made arrangements for determining the percentage of butter-fat for a fee of sixpence per sample. A list of these institutions is given on p. 3.

"It must, however, be understood that :—

"*a*. The report sent will refer only to the percentage of butter-fat.

"*b*. Each report refers only to the sample tested, and implies no guarantee whatever as to the bulk.

"*c*. Each report is supplied solely for the information of the milk producer, and must not be used as evidence in case of any dispute between seller and buyer, or where the quality has been questioned by any public authority.

"The directions issued by the institutions must be carefully observed. They require, as a rule, that :—

"1. The fee of sixpence should be sent with the sample. In the case of Essex, however, the fee charged by the country is one shilling ; while no charge is made by the West of Scotland Agricultural College to farmers residing in the countries contributing to the support of that body.

"2. A stamped and addressed envelope should be sent for the report.

"3. Samples should not be sent so as to arrive between Friday night and Monday morning.

"4. If it is proposed to send samples periodically, as may be in many cases advisable, the institution should be so informed.

"5. The sample bottles should be carefully sealed and packed in accordance with the requirements of the General Post Office, and the postage prepaid.

"6. The following instructions as to taking samples should be closely followed :—

INSTRUCTIONS FOR TAKING SAMPLES.

"*A. Testing the Milk of one Cow.*—The sample should be taken immediately after the cow has been milked. To ensure thorough mixing the milk should be poured from one vessel into another several times and a small quantity then quickly removed and immediately transferred to a clean bottle, capable of containing at least a quarter of a pint. The bottle should at once be corked and sealed.

"*B. Testing Mixed Milk.*—In taking a sample from the milk of a herd it is often impracticable to mix the milk by pouring it from vessel to vessel. The sampling may then be done by using a strong glass tube, obtainable from any chemist, of about three-eighth inch bore and open at both ends. The tube must be sufficiently long to reach the bottom of the can, and should be slowly passed perpendicularly into the can until it touches the bottom. If this is done carefully it will then be found that the milk in the tube stands at the same level as the milk outside. The *upper* end of the tube should then be firmly closed with the thumb, when, if the tube is carefully withdrawn, the column of milk will remain in the tube, and may be emptied into a clean bottle by gently releasing the thumb so as to admit air. Samples taken in this way from all the pails should be thoroughly mixed in the same way as the samples from a single cow.

"If a glass tube is not available, the milk must be mixed thoroughly by pouring from vessel to vessel; stirring it is not enough.

The bottle in which the milk is sent should be full, and a label should be affixed to it, bearing the name of the sender, full postal address, and the date on which the sample was taken,—Leaflet No. 146, *Board of Agriculture and Fisheries*, England.

721.—THE PREPARATION OF HONEY FOR MARKET.

Qualities of Good Honey.

The bee and honey classes of the shows now held during each season, both in London and the country, have taught the consumer what to require in a first-class honey. Comb-honey (in section cases) should be translucent, showing the clear bright colour of the contained honey, evenly and delicately worked out to the sides and bottom of the section, and with a scrupulously clean surface. The finest liquid, extracted-honey, should be bright and clear, of a light straw colour, and delicate in flavour and aroma. Granulated extracted-honey should be of fine, even grain, creamy white in colour, and of good flavour. There are many grades of medium and dark-coloured honeys below this first-class standard, but the latter is what the bee-keeper must strive to attain, in order to command a ready sale for his produce.

Preparation for Comb-Honey in Sections.

In regard to comb-honey, the preparation commences with the fitting of the wax foundation in the section boxes. To ensure a well worked out section this should be cut so as just to clear the sides of the box and hang to within one-sixteenth of an inch of the bottom, thus allowing for a slight stretching of the foundation caused by the heat of the bees clustering on its surface. The fitted boxes must next be placed in the section rack, with separators between the rows, reaching to within three-eighths of an inch of the top and bottom, and wedged up perfectly square and tight; this is important, for the bees will place *propolis* over every crack or small space, causing disfigurement and extra work in cleaning; also sections "out of square" are much more liable to breakage when packed for travelling, owing to the unavoidable spaces between them. The rack must be placed perfectly level on a hive containing a strong colony of bees, if will then be filled with good, straight, and even combs.

Removing Filled Racks.

Removing filled racks from the hives should be done with as little disturbance to the bees as possible: the best method is to place a "super-clearer" on a stool or box by the side of the hive, raise up the bottom edge of the rack and insert a small wedge: puff a little smoke between the rack and tops of the frames, then remove the rack steadily with a screwing motion, and put it down gently on the "super-clearer"; then place a cloth, on which a few drops of carbolic acid have been sprinkled, over the top of the frames. In about ten seconds remove the cloth, and it will be found that the bees have been driven down, leaving the tops clear; then immediately take up the rack with the "super-clearer" and place them on the frames. If this operation is carried out in the afternoon, by next morning every bee will have found its way down to the body of the hive through the bee-escape in the centre of the "super-clearer," and the rack can be removed with comfort to the bee-keeper and without disturbance to the apiary.

The full racks should be carried into a bee-proof room, the wedges and back-board removed, and the centre section of the exposed row taken out. Do not attempt to lift it straight out, the result would probably be a damaged section, but tilt it backward on its bottom edge, and when loosened it will come away easily, as also will the two side ones. Sort the sections as they are taken out, putting all well-filled clear ones as the first grade: those not well worked to bottom and sides, and therefore not fit for travelling, make a second grade, and any only partially filled must be given back to the bees to finish, unless the "honey-flow" has ceased, and in that event they must be emptied by the extractor. Carefully scrape all propolis from the edges of the sections and, if not already sold, store them in a dry, warm cupboard, protecting them from dust by tying in packages of four or six in clean paper; be very careful not to place anything having a strong odour near the honeycomb, or it will spoil the flavour.

Packing.

If the sections are sold to wholesale dealers for re-sale to traders, no further preparation is needed. To pack them so as to travel safely,

not more than from four to six dozen should be put into one package, preferably the smaller quantity. Procure a strong wooden box, bore two holes in each end, about one-third down, and knot firmly into them rope handles, by which the box can be safely and easily lifted; put into the bottom of the box a bed of coarse hay, and on this place, quite close together, a layer of the wrapped-up packages of sections, leaving at least two inches between the sides of the box and the sections: this space must be filled with hay, tightly pressed in, and, to prevent possible damage to the comb, the ends of the packages may be protected by pieces of straw-board or thin wood. Continue with layers of packages, filling in round the sides as before, until within two inches of the top, then fill up tightly with hay and *screw* on the lid. Label the package plainly: "Comb-honey, With Care." Retailers of honey-comb prefer to have the sections sent to them glazed, the comb being then preserved from injury by careless handling, and what is still more important, kept free from the dusty impurities unavoidably present in shops.

Glazing the Sections.

For glazing sections, glass cut to the correct size may be purchased of any dealer in bee appliances, together with the strips of paper lace edging, which, when pasted round the angle formed by the glass and wood, serve to fix the glass on. In country towns the local glazier will gladly cut up waste glass to the small size (viz., $4\frac{3}{16}$ in. by $4\frac{3}{16}$ in.) required, while neatly printed bands of coloured paper, 19 in. by 3 in., can be used instead of the lace edging. These bands cost about 7*s.* per 1,000. They are more easily pasted on than the paper lace edging, and make much firmer and neater work, while they also give an opportunity of placing the names of the apiary and retailer on each section. Neat card-board cases plain or glazed on one or both sides, and glazed tin boxes, are provided by appliance dealers for those who have but a small number of sections to deal with; where larger quantities are handled, the printed band holding on the two squares of glass will be found the best and most economical.

Extracting Honey.

The modern method of obtaining "extracted" or "run" honey has greatly improved its quality, and the use of the centrifugal extractor compels the abandonment of the skep system of bee-keeping, with its waste of bee life, waste of combs, and taint of sulphur; it also necessitates the adoption of the frame hive, which enables the gathered surplus to be stored in frames apart from the brood-nest and removable at will by the bee-keeper.

Honey improves in flavour and density while ripening in the hive, therefore the super-frames should not be removed until they are well sealed over.

Fermentation is the great enemy of extracted honey, but it can only effect badly ripened honey or honey exposed to moisture and warmth; so, should it be necessary to extract unripe honey, it should be returned to the bees for re-storing and ripening. Extraction is done by means of a machine consisting of a a tinned-iron can, within which is a vertical spindle carrying a pair of cages to hold the frames of honey-comb and made to revolve rapidly by means of a simple hand-

gear. Before placing the frames of comb in the cages they must be uncapped. To do this quickly and without waste special uncapping knives are used; they should be heated in a tin of water kept hot over a small spirit or oil lamp. The full frame, held by one lug in the left hand, the other lug resting on a large dish and with the top edge overhanging, has its capping removed with the sharp, hot knife by a gentle, slightly sawing, downward cut, passing just beneath the surface and removing as little as possible of the honey. If held with sufficient overhang the detached sheet of capping will fall clear of the frame. A pair of frames having been uncapped they are placed in the cages of the extractor and made to revolve rapidly with their bottom bars leading; the centrifugal force throws out the honey, and when one side has been emptied the frames are reversed and the other side treated in the same manner.

The full sealed frames of comb having been carried into the store-room should be sorted by holding up to the light, and all those containing dark or second quality honey separated from the better ones.

Uncap and extract the contents of the best combs, and then strain the honey through a bag made of cheesecloth in order to remove all loose particles of wax. Tin cans, with strainer and honey tap made to contain 56 lbs. or 112 lbs., can be obtained, in which, if the honey is allowed to stand for twenty-four hours after straining, it will be freed from air bubbles, and can then be drawn into whatever bottle, jar, or tin will best suit the local market. Best honey is usually put into 1 lb. or ½ lb. glass jars, with metal screw lids having a cork wad inside the lid. To prevent any leakage the cork wad should be dipped in melted wax and placed on the jar while still warm, the lid being screwed down upon it. A neat label (of which a variety are always obtainable from the appliance makers or of the Secretaries of many of the County Bee-keepers' Associations) will set off the honey jar and and make it more attractive. The darker honey is more suitable for marketing in its granulated state; when extracted and strained it it should be run into 14 lb. or 28 lb. tins, the contents of these being stirred gently, now and again, while granulating; the stirring tends to produce a more even and finer grained honey. It may also be run into wide-mouthed glass or earthenware jars covered down with parchment paper, and stored in a cool, dry place. Dark and coarse-flavoured varieties may be sold for manufacturing and confectionery uses, or for that now almost forgotten purpose, the making of mead.—Leaflet No. 141, *Board of Agriculture and Fisheries*, 4, Whitehall Place, London, S.W., May, 1905.

722.—THE "RIND FUNGUS" OF THE CANE.

The West Indian Section of the Colonial and Indian Exhibition was decorated with a screen constructed with full grown sugar canes received from Jamaica, Trinidad and Barbados, in the month of May, 1905.

In the month of July, some two months after erection these canes were seen to be covered with a thick growth of "Rind fungus," so much so, as to blacken the hands whenever they were touched. The

Jamaica, *Trinidad*, and *Barbados* canes presented the same appearance, all being equally affected.

The subject of the universal presence of this fungus was, I find, discussed by Dr. Watts at the Agricultural Conference, 1901, as recorded in West Indian Bulletin, Vol. 2, p. 55.

In the Jamaica Court were plants of growing canes, standing almost in contact with the cut canes, which were not visibly affected.

The fact of its occurrence at the Crystal Palace is placed on record here, as a small contribution to the history of this disease.

723.—A NOTE ON COTTON.

Cotton plants, raised from seed obtained from the West Indies, were cultivated at the Chelsea Physic Garden as long ago as 1732. From these specimens the species *Gossypium hirsutum* was originally described by Linnæus.

A supply of seeds from these plants was later sent to the United States, and there is reason to suppose that the stock of American Upland Cotton was, to some extent, originally derived from the West Indies *via* the Chelsea Physic Garden.

724.—"WET CACAO" AND "DRY CACAO."

By "wet" cacao, is meant the beans freshly taken from the pods—and by "dry" cacao is meant cacao ready for the market. It being found desirable to have authentic *data* on hand from which a fair estimate can be obtained of the amount of marketable produce it is possible to obtain from any given weight of fresh or wet cacao, an experiment has been started at *River* estate for this purpose, and the returns of the first trial are now to hand.

A picking of 11 barrels of wet cacao weighed when brought in	2,600 lbs.
(*a*.) The loss during fermentation was 15·5 per cent. or 403 lbs.	
(*b*.) The loss of weight in drying after fermentation was 54·44 per cent. or 1,195 lbs.	
(*c*.) The total loss during drying and fermentation 61·46 per cent. or 1,598 lbs. ...	1,598 lbs.
Marketable cacao produced ...	1,002 lbs.

Further trials will be made, as it is evident the gross weight of "wet" or "dry" cacao will vary with seasons.

It is thought however that four trials will be sufficient to obtain a fairly good average which will be of value for calculations in Trinidad, but it is not clear that these would admit of comparison being made with the crops of other countries or of other estates in Trinidad.

725.—"YELLOW STAR APPLE"?

Under this name Mr. J. C. Lewis of San Fernando sent us some years ago seed of a fruit received from Brazil.

From this a tree was raised which has now produced a crop of fruit, which has a nice appearance, but at present has little to recommend it for the table. This is what I wrote after my first taste. Fourteen days afterwards I again tried the fruit and found it riper, of excellent flavour, and a decided acquisition. It reminds one of the fruit of the "balata," but it is three times as large and much prettier in appearance. I now think it has much to recommend it for the table.

The fruit is yellow—one seeded, globular, about 2 inches in diameter, and probably belongs to the genus *Sideroxylon*, and not to the "Star Apple" or *Chrysophyllum*. From specimens now obtained it is hoped to get an authentic determination of the tree shortly.

726.—COFFEA ROBUSTA.

A NEW VARIETY FROM THE CONGO RIVER, WEST AFRICA.

Plants of this kind of coffee have done remarkably well at the Experiment Station, St. Clair, and under the authority of His Excellency Sir Henry Moore Jackson, K.C.M.G., Governor of Trinidad, a free distribution has been made. Plants were distributed to the number of 1,800 to 154 estates. The readiness with which this new plant has been taken up is a satisfactory sign of the interest taken by local planters in new products. Numerous applications were received after the lot set aside for free distribution was exhausted, the whole number being taken in one month from the date of advertisement offering same.

The plants sent out were strong healthy plants 1 year old. The value of the distribution is estimated at $180.

727.—CACAO AT THE AGRICULTURAL CONFERENCE, 1905, HELD IN TRINIDAD.

A useful discussion on the cultivation of Cacao took place at the late Agricultural Conference of January last, the full report of which is published in West Indian Bulletin, Vol. VI, No. 1, 1905. As

many of our readers have not the opportunity of perusing this publication, it is reprinted here for circulation.

It will be found that the discussion touched the important points of manuring, shade, treatment of disease, varieties, methods of cultivation, &c., &c., and elicited a variety of views from gentlemen who attended from sister colonies, which deserve the fullest attention.

EXPERIMENTS IN IMPROVING THE HEALTH AND PRODUCTIVENESS OF COCOA TREES.

Mr. J. H. Hart (Trinidad): Our experiments have only just been initiated and have hardly reached a stage to justify saying anything about them. One or two things have, however, been brought to the notice of planters, and have, I am glad to say, been taken advantage of with considerable success. The first is the method of dealing with the pod disease. The methods suggested by me to the Trinidad Agricultural Society, and also by the Imperial Department of Agriculture, which consist in the burning, burying, and disinfecting of diseased pods, have been especially successful in dealing with the disease called *Phytopthora*, and I was agreeably surprised to be told recently that, as the result of their adoption on one of the largest estates in the island, proprietors expected to get 25 per cent. more cocoa than he otherwise would have done. Mr. de Gannes has also adopted similar treatment with equal success. Another thing which we have been trying to impress upon small planters especially is the desirability of pruning cocoa trees so as not to leave wounds which cause rot of the centre of the stem. Again, where wounds and holes occur we strongly recommend a system of cleaning them and filling them with a mixture made of ordinary cement and sand. This gives the trees renewed vigour and prolongs their life for many years. Tar is also recommended for use when pruning and I am glad to say the practice has been adopted on a large number of estates. Few manurial experiments have as yet been carried out, but those recommended are being adopted, and I shall be able to report on them at a later period.

Mr. J. G. de Gannes (Trinidad): With few exceptions the cocoa cultivation in this Island has received, up to a year or two ago, little attention beyond the ordinary method of upkeep handed down by our forefathers, but it seems now as though the cocoa planters are realizing the necessity of higher cultivation. So far, artificial manures have not been extensively made use of, but where they are being tried, the results are encouraging. Basic slag is the manure most generally applied. Some very good results are obtained by the use of pen manure prepared with gypsum, and on some very old properties its use, and that of sheep manure forked in, have been remarkable in improving the health and productiveness of the cocoa trees. The

island has had up to now, thank God, few cocoa diseases to contend with, the 'Brown Rot' and 'Canker' being the only two. The measures successfully adopted to combat them, have been the treatment suggested, I believe, by the Imperial Department of Agriculture, and with the advice and assistance of Mr. Hart, the Superintendent of the Botanic Gardens here, they are kept under control. The cocoa trees of the plantations situate in the valleys suffer considerably from 'moss' on account, I presume, of the excessive moisture, and it would be desirable if some other and more efficacious means than the brush or the hand—the 'knapsack' sprayer having totally failed for the purpose—should be found to deal with it. There are several patent cocoa dryers of different patterns used for the curing of the cocoa bean and I am informed that they give satisfaction, but personally I shall adhere to the opinion that the sun-dried article is preferable. With regard to green dressing I am not aware that it is resorted to to any great extent. I gave it a trial on one of my properties in October last, and so far I have not noticed a very marked change in the look of the trees. In conclusion, I regret that, owing to the short time since experiments have been started in the Colony, I have no statistics to offer.

The President: With the object of assisting the cocoa industry in Grenada, St. Lucia and Dominica, we undertook a series of what we called sample plots of cocoa; that is to say, we took over plots of land, about one acre in extent, near the public road from proprietors who were willing to allow us the use of the land, and to assist in the cultivation. These plots were labelled 'Imperial Department Plots.' In most cases they consisted of cocoa which was not in good health. The Department paid the expense of cultivation, the Agricultural Instructor visited these plots, which became central points for giving information to cultivators in the district. The planter who gave the use of the plot became the agent of the Department in his district, so that when the Agricultural Instructor visited the plot he would see the planter and discuss with him the best way of utilizing his time while in the district. Sometimes it was suggested that a meeting would be held at which the cocoa growers in the district should be present. After the Instructor had been introduced to them by a person they knew, they were ultimately willing to receive and hear the Instructor and follow his advice. Some people might regard the establishment of sample plots as giving assistance to the large proprietors by taking a portion of their land and cultivating it for them. However, we are quite satisfied with the results, as the feeling that has been created among small proprietors by our taking an interest in their cultivations has more than repaid us for the trouble and expenses which the establishment of these plots has occasioned. As the result of sample plots in Grenada, a paper in connection with one of these has been circulated among members of the Conference. Peasant proprietors who had scouted the idea are now making drains and pruning their trees, applying manures and fully carrying out the recommendations of the Department. I believe these sample plots have been very beneficial. We have gone through our first series and should now begin another. The plots in Dominica I

hope to place under the supervision of Dr. Watts, so that he can make experiments with chemical manures and carry on the work more closely on scientific lines. Mr. Hudson has had charge of the plot in St. Lucia and he will be able to tell you himself what is being done there.

Cocoa Manurial Experiments at Grenada.

The following report and table, showing the results of the working of the cocoa experiment plot at Nianganfoix estate, Grenada, were forwarded by the proprietor for publication (see *Agricultural News*, Vol. III, p, 347) :—

This plot was handed over on September 30, 1903, by the Department of Agriculture to the proprietor who still carries on the experiments, in order to obtain the highest possible yield from an acre of land by the use of fertilizers and green soiling.* The plot measures 1 acre and was divided into four sections of $\frac{1}{4}$ acre each.

During the period, extending over four crops, from April 1, 1900, to September, 30, 1904, two applications of manures were made, as shown in the table, the first during the first crop 1900-1901, and the second application in the spring and summer of 1902 just before rhe third crop.

A, the pen manure section, is the wettest section of the plot, and it will be noticed that, notwithstanding the heavy application of manure in May 1903, the yield fell below the two preceding crops, and only recovered after several rods of new drains had been added to those already existing—and dug diagonally across the slope. This illustrates the value of drains in a wet clay soil, without which manure is at a discount.

The potash section D has steadily advanced and, unlike sections B and C, which unaccountably fell off by $\frac{1}{8}$ to $\frac{1}{4}$ bag, held its own during the crop 1902–3. The cost of production for the first two years averaged £1 per bag of cocoa, and for the second two years 12s. per bag, or an all-round average of 16s. per bag for four years' working.

When the results of the fifth year's working are known, the cost of production will be considerably reduced.

The following figures show the gradual improvement in yield :—

Crop 1900–1 = $5\frac{1}{4}$ bags per acre.
Crop 1901–2 = 7 ,, ,,
Crop 1902–3 = 7 ,, ,,
Crop 1903–4 = 8 ,, ,,

Full particulars are given in the following table as to the details of the treatment accorded to the various sections :—

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* The sections have been bedded twice yearly.

Section.	Manures applied (with dates).	Crop 1900–1.		Crop 1901–2.		Crop 1902–3.		Crop 1903–4.	
		Dry Cocoa per sectional acre (pounds)	Bags per acre.	Dry Cocoa per sectional acre (pounds)	Bags per acre.	Dry Cocoa per sectional acre (pounds)	Bags per acre.	Dry Cocoa per sectional acre (pounds)	Bags per acre.
A. ¼ acre.	June 1900— Pen manure, 3 baskets per tree, 15 tons per acre May 1902— Ditto [Extra drains dug, August 1902.]	1,036	$5\frac{5}{8}$	868	$4\frac{3}{5}$	808	$4\frac{1}{2}$	1,184	$6\frac{1}{5}$
B. ¼ acre.	August 1900— Basic slag, 8 cwt. per acre February 1901— Sulphate of ammonia, 1½ cwt. per acre May 1902— Basic slag, 8 cwt. per acre August 1902— Sulphate of ammonia, 1½ cwt. per acre.	1,112	6	1,572	$8\frac{1}{2}$	1,512	$8\frac{1}{4}$	1,648	

Section.	Manures applied (with dates).	Crop 1900–1.		Crop 1901–2.		Crop 1902–3.		Crop 1903–4.	
		Dry Cocoa per sectional acre (pounds)	Bags per acre.	Dry Cocoa per sectional acre (pounds)	Bags per acre.	Dry Cocoa per sectional acre (pounds)	Bags per acre.	Dry Cocoa per sectional acre (pounds)	Bags per acre.
C. ¼ acre.	August 1900— Basic slag, 8 cwt. per acre February 1901— Nitrate of soda, 1½ cwt. per acre May 1902— Basic slag, 8 cwt. per acre August 1902— Nitrate of soda, 1½ cwt. per acre	888	4¾	1,324	7⅛	1,309	7	1,492	8
D. ¼ acre.	August 1900— Basic slag, 8 cwt. per acre, and sulphate of potash, 1 cwt. per acre, (mixed) ... May 1902— Ditto	860	4⅝	1,472	8	1,488	8	1,612	8¾

Mr. J. H. Hart: We have established in Trinidad one experiment plot on the same lines as the Grenada plots. It is at Brasso and in charge of Mr. Carl de Verteuil. It was only started a few months ago, and the results will not be available for some time.

Mr. G. S. Hudson: (St. Lucia): Experiments in improving the health and productiveness of cocoa trees have been carried on in St. Lucia under the Imperial Department of Agriculture now for five years. Our Method, as Sir Daniel Morris has said, has been that of taking up the most unhealthy portions of cocoa we can find adjoining the main-roads, so as to bring our work as much as possible before passers-by. The results have been exceedingly saatisfactory. In many cases the trees had actually stopped bearing; in others, the yield was only 56 lb of dry cocoa per acre when the plots were taken over. In three years the yield had been increased to 7 bags. The policy is, as soon as we attain that standard of improvement, to hand the plot over to the owner and take a new plot in the same or another district. In our five years' experience we find we get the best results from the following method: forking throughout the plantation in January; then applying broadcast eight cwt. of basic slag between January and April; that is followed by draining where necessary, and then thorough pruning. We find pruning to be of very great importance as it admits sunlight. After this, thorough cleanliness throughout the year. Three to four weedings are usually sufficient, but sometimes as many as six has been found necessary. In August or September we apply sulphate of ammonia to each tree. I observe from the results of the experiments in Grenada that the best results there have been obtained from an application of sulphate of potash. In 1902 we applied nothing but potash to a 6-acre or 7-acre plot, and the results were negative in every case. I may mention, however, that, in combination with basic slag, the experiment has proved very valuable; but the best results were obtained from a combination of slag and nitrogen. We have also tried superphosphate but have not found it advantageous. We have obtained good results from ground bone, but that is rather expensive. Pen manure is undoubtedly the best system of manuring, but the difficulties of transportation prevent its general use. Chemical manures yielded as good results and at less cost. The only fear in the application of chemical manures is that too much nitrogen may be applied to certain soils, but in light soils, there is nothing to fear. Many planters seemed to fear forking, on the ground that it injured the trees, but I have never seen any bad results from careful forking. On the contrary, the results have been excellent. As the result of the experiment plots, planters in St. Lucia are now importing basic slag and sulphate of ammonia—a thing unheard of before—and pruning and forking have now become a recognized part of cocoa cultivation. As a rule we do not find it necessary to use tar or cement except in cases where a fungus disease is affecting the trees.

Dr. H. A. A. Nicholls (Dominica): Until the last quarter of a century the exports of Cocoa from Dominica were very small, as it was produced only by peasant proprietors. When, however, the crises overtook the sugar industry, many of the sugar planters, feeling the effects of the hard times, planted up portions of their estates in cocoa and limes, and so from that time the exports of cocoa began to

increase. The Treasurer of the island has very kindly furnished me with certain returns which include the exports of cocoa for the last ten years, which are as follows :—

EXPORTS OF COCOA FROM DOMINICA.

Year.	*Export.*	*Year.*	*Export.*
1894–5	851,334 lb.	1899–1900	968,740 lb.
1895–6	499,113 „	1900–1	992,586 „
1896–7	946,393 „	1901–2	1,052,693 „
1897–8	885,024 „	1902–3	1,309,577 „
1898–9	1,082,851 „	1903–4	1,285,245 „*

From this return I observe that in 1895–6 there were half a million pounds of cocoa exported ; but when we come to 1902–3 it is found that the exports had increased to one and a third million pounds. Last year, that is, 1903–4, there was a decrease owing to the hurricane, which although not directly striking Dominica, seriously affected the crop. But notwithstanding this the exports of cocoa reached one and a quarter million pounds. During the last few years a good deal of attention has been directed to Dominica : a new road opening up the rich land of the interior, has been made with money granted by the Imperial Parliament and it has appropriately been called the Imperial Road. We have young Englishmen with moderate capital constantly coming out, and some of them have gone into the interior, cut down forests, and created estates, and in many instances they have planted cocoa. It must, however, be borne in mind that the increase in exports to which I have referred is not due to the new planters, but entirely to the older planters, who, seeing that sugar had failed, set their energies to work in another direction ; therefore it is the industry and enterprise of the older planters—the men who have borne the heat and burden of the hard times—that have brought about the dawning prosperity of Dominica. When, however, the new settlers' estates begin to bear, then it will be found that Dominica will make a sudden leap forward along the path of progress. Coming to the cocoa tree itself, I should like to make a few observations in regard to the facts brought before us by former speakers. Taking the case of pruning, I would thoroughly commend the remarks made by Mr. Hart, just as I would depreciate those made by Mr. Hudson. If you wish a good tree to do well and to bear well you must perform the operation of pruning with great care. I think the Mycologist of the Department will tell you that if you cut off the branches and limbs of trees and do not tar the wound, you would probably get fungus diseases in the wood ; the Entomologist of the Department will also tell you that there could not be a better site for the entry of boring beetles and such like insects pests than the unprotected wounds left by bad pruning. The more intelligent planters in Dominica use tar, and also fill up with clay any holes or deep depressions that may be found in the tree whereby water might collect or insects get shelter. As regards manure, in days gone by the greater part of the exports of Dominica came from the peasant proprietors who had not the advantage of having brought before them as in the case now, the scientific and technical knowledge of the Imperial Department of

* Gale in August and partial failure of crops.

Agriculture ; they allowed their trees to grow as they might, and did not manure them, with the result that the trees have deteriorated very considerably. The manure that is found most useful in regord to cocoa cultivation is exactly the same that is found most useful in cane, and indeed in almost any, cultivation, that is farmyard manure. There can be no better manure, not only from its chemical constituents, but also its mechanical effects : it improves the soil whilst it provides food for the trees. But where you have estates far in the interior or on steep hillsides, and with a few animals, it is almost impossible to obtain sufficient farmyard manure, and in such instances it is necessary that artificial manure should be used. Hence the Dominica estates used basic slag, which contains phosphates and some free lime, and nitrogenous manures in the form of nitrate of soda or sulphate of ammonia. But in regard to nitrogenous manures it must be remembered that in Dominica, St. Lucia and other such Islands an immense quantity can be got in the forest lands by using dead leaves, lopped shrubs, and grass as a mulch for trees, and afterwards by forking this decayed vegetation into the soil. There is also a loss of nitrogen attendant on the cultivation of land in the tropics, and it must be restored by the use of farmyard manure, by green dressing, or in some other way. Mr. Hudson recommends keeping a cocoa plantation thoroughly cleared of weeds. That is opening up the question brought before the last Conference by Dr. Watts who advised that in cocoa and similar cultivations the lands should not be kept entirely free of weeds, but that the weeds should be allowed to grow for a time and then cut down ; so that the cultivation would practically get a green dressing. That is the system that has been universally adopted in Dominica for many years, and it would appear to me to be the one best suited to local conditions. There is a matter which I omitted to allude to and which may be regarded as one of the main causes of the small crops now got from peasant holdings. In removing the pod from a cocoa tree it is necessary that a portion of the stem attached should be left on the tree, but the ignorant peasant, instead of cutting the pod, wrings it off, with the result that the little bud at the end of the stem which will supply the future pod is torn off, so that in time the bearing portions of the stem are materially reduced in number. This is a matter to which Agricultural Instructors in Dominica and other islands should call the attention of peasant proprietors.

The Rev. Dr. Morton (Trinidad) : I go about among many peasant proprietors in Trinidad, and I know that the teaching of the botanist, the chemist, and the analyst has had a great effect upon them in the matter of cultivating their land. One matter referred to by Dr. Nicholls is of great importance to them, and that is the application of manures. They should be urged to use the natural manures which they can get without laying out money. Sometimes they have no money. The names of artificial manures are all new to them, but they know pen manure ; and some of them from Barbados know the value of it, and the distinction made between pen manure that has been kept covered or been trampled, and pen manure that has been exposed to the sun or washed out by rain. We see in our villages today, as the result of cane-farming, the peasant proprietor's cart going out every morning half-loaded with manure, to be returned to the

soil. Not only is that the case with the ordinary manure made in the village, but the peasant proprietor has also taken to the use of liquid manure. At the Government Stock Farm where the stalls are concreted, the liquid manure which collects in little wells is daily removed by peasant proprietors. This practice is also carried out in St. Joseph and has resulted in an improved sanitary condition. What Dr. Nicholls has said in reference to weeds and shrubs is perfectly true. In some cases, such as rice cultivation, the only manure which goes into the soil is the grass and weeds which grow for six months during the dry season. The practice is also valuable in connexion with cocoa estates.

The Hon. Wm. Fawcett (Jamaica) : I have listened with a great deal of interest to the discussion that has taken place on the cultivation of cocoa. The cocoa industry in Jamaica is of considerable importance, although rather overshadowed by the banana industry. There we do not look upon it as you do in Trinidad and Grenada, as one of your great industries : it is rather a subsidiary industry in Jamaica: but I hope it will become in time one of our great industries. The reason why it has not advanced quicker is that the banana has been so very important. But now the planters, seeing the bad effects of hurricanes, are gradually beginning to plant their banana estates with cocoa, and some have turned their banana estates altogether into cocoa estates. So we wish to get hints as to the cultivation, pruning, curing and especially shade. We owe a great deal to Mr. Hart for having written such an excellent handbook on cocoa : we in Jamaica consider it a very practical and important book. With to reference Criollo cocoa and Forastero cocoa, we have been much exercised in Jamaica for some time as to which is better to plant. Some planters do not think Criollo a robust plant, asserting that it is subject to disease and pests at all times. I should like to get some information from planters in Trinidad on that point. In Venezuela, where they have large estates of Criollo, some trees have died out, and attempts have been made to supply their places with Criollo, but without success, although Forastero will grow. The estates are therefore deteriorating. I should like to know whether this has been found to be the case also in Trinidad. Do you find you can plant Criollo and keep it up, or have you gradually to revert to Forastero ? We have in Jamaica a considerable tract of land in the western part where the remains of cocoa are still found growing, and almost without exception the variety is Criollo. Some of these trees are said to be 100 years old and yet they are bearing heavily and doing well. But the question is whether the seeds from these trees can be utilised for establishing new estates of pure Criollo. With reference to the question of Criollo growing well and being supplied where it is already established, I wander whether a system of budding on strong stocks would not apply. For instance, on estates in Venezuela, where they found they could not successfully establish Criollo in vacant places and have had to plant Forastero instead, would it not be possible to bud on the Forastero from their Criollo tress ? We have been experimenting with budding and found we can do it with success. Again, in our cocoa estates we find many of the trees do not bear anything like as well as other trees, and we want to know whether we cannot improve them Will it not be advisable to cut down those trees and bud on the shoot

that springs up, from one of the more valuable trees on the estate? Another matter we do not understand is shade. That seems to me to be a very complicated question. In Grenada they do not use any shade and in Trinidad they use shade everywhere and find they cannot do without it. What is the reason? Is the shade wanted for the trees or the soil? If it is wanted for the soil, then you do not want shade trees, as the cocoa will provide its own shade. Is it necessary to have shade at all, or is it a question rather of cultivation? Do the roots of shade trees keep the ground open, or might that be overcome by the use of cultivators? One of our most practical agriculturists in Jamaica started five or six years ago a cocoa estate in the middle of the island, and he is convinced in his own mind that there it is necessary to have shade. But on the north side of the island it has been proved that shade is not required. I am inclined to think that shade produces moss on the trees and leads to fungus disease which might otherwise be avoided, and that the more sun you can reasonably allow to the cocoa trees, the heavier the crops will prove.

Dr. H. A. A. Nicholls: The practice in Dominica is not to use shade, but trees are planted, in some cases running along lines, so as to serve as wind-breaks. I remember that fourteen years ago when I made my second visit to Trinidad I was told that shade was necessary; so I obtained seeds of Bois Immortel from a friend and planted them among my cocoa. I was very sorry I did so; but the hurricane, which did so much damage to the cocoa estates in Dominica, did me some good in throwing down my Bois Immortel. The experience of the Dominica planter is that cocoa grows better without shade than with it. I was exercised in mind a good deal by remarks made to me some years ago as to the advantages of a tree which is used here as shade I was gravely told by some planters that the Bois Immortel is very beneficial, inasmuch as it gives out water from its roots during the dry season. We can well understand that such trees do good, but in a different way; their roots naturally would go further into the subsoil than the roots of cocoa, and they draw from the subsoil certain constituents which will later on be shed upon the land in the shape of dead leaves and twigs and flowers, and much nitrogenous matter would be supplied to the land in the form of humus. But we must also remember that these plants belong to the order called *Leguminosæ*, which have nodules on the roots, and in these nodules are micro-organisms called bacteria, which have the power of drawing the nitrogen from the air and fixing it in the soil, and in that way nitrogen is supplied to the surrounding plants. It appears to me, therefore, that the benefits of the shade trees in Trinidad are not due so much to the shade, but to the manure they give to the soil.

Mr. E. M. de Freitas (Grenada): At one time we planted a great deal of shade trees in our cocoa estates in Grenada. In fact we adopted the Trinidad system. After a time we found that the trees which were not shaded gave better results. Then about ten years ago planters began to cut down their shade trees, and at the present time, with perhaps one exception, I do not believe there is an estate in the island on which shade trees are grown. I have always been puzzled to know why in Trinidad cocoa cannot be grown without shade. The soil here is somewhat different to that in Grenada; it is a stronger soil and has more clay. Having regard to the value

of cocoa cultivation, amounting to £900,000, and in view of the great difference between the yield here and in Grenada where we do not use shade, I think it would be advisable, for the Imperial Department of Agriculture to carry out experiments in Trinidad with the view of finding out whether they cannot grow cocoa here, as we do in Grenada without shade. With regard to the question of improving the health of trees, we use sheep manure. We raise sheep not for mutton, but for the manure which commands a very high price on the local market.

The President: There is one point of difference between the cocoa trees in Grenada and those in Trinidad. The trees in Grenada are much smaller and planted closer. The question is one of great importance—not for the Department—but for the planters of Trinidad. The Department will be happy to assist Trinidad in the same manner and to the same extent as the other islands. The wide question which Mr. Fawcett has brought up—whether as a general principle shade trees are necessary in cocoa cultivation, can only be answered by trying to find out whether in Jamaica they want shade trees at all, or want shelter belts. It would be useless to follow blindly the experience of Grenada and Trinidad, because the circumstances of the two places are so different from those of Jamaica. In Jamaica they are liable to hurricanes, whereas in Trinidad and Grenada they are not. I believe in Dominica and the Northern Islands they grow the Pois doux (*Inga dulcis.*)

Dr. H. A. A. Nicholls: They use it for shelter belts, not as a shade tree.

The President: I should like to ask Mr. de Gannes what he regards as an average yield either per tree or per thousand trees in Trinidad?

Mr. J. G. de Gannes: Twelve bags, of 170 lbs. each, to each thousand trees planted 12 feet apart.

Mr. E. M. de Freitas: The average yield in Grenada is 4 bags, of 196 lb. each, per acre.

The President: So far, we have had no experience as to the relative values of Criollo and Forastero.

Mr. J. G. de Gannes: Criollo was put aside altogether because the yield was poor: it is a delicate tree for Trinidad. I understand that even in Venezuela there are certain parts of the country where it does not thrive at all.

The President: Would it be any advantage to graft the Criollo on to the Forastero stock?

Mr. J. G. de Gannes: It might be tested on a practical scale.

Mr. J. H. Hart: Our experience with grafting is very small at present. The Forastero is the strongest-growing cocoa, but the Criollo produces a cocoa of the highest quality. The question of shade, I think, might be usefully gone into. I have discussed it many times, and have come to the conclusion that shade is absolutely necessary for Trinidad. I am equally certain that shade is not necessary for Grenada. I have heard the story of a Grenada planter who came to Trinidad to teach the planters here how to grow cocoa

without shade. He bought an estate and carried out the experiment by cutting down all the shade trees with the result that he had to replant them, as he found it impossible to grow cocoa here without shade. If ever you see a bad patch of cocoa here the planters' explanation is that the trees have not sufficient shade.

The President: I should like to suggest for the consideration of the Agricultural Society whether during next year they could put an acre of the Criollo variety of cocoa in cultivation. The results might be sufficiently reliable to justify an extension of it later on, or to abandon it altogether. I know Mr. Hart would be willing to join in an experiment of that sort, and it would be useful to the Colony.

Dr. H. A. A. Nicholls: Mr. Hart has declared, *ex cathedra*, that cocoa cannot be grown in Trinidad without shade trees. I do not think the argument used by him fully warrants that declaration, because one can very well understand that cutting down shade trees from among cocoa trees brought up with shade, is very different to growing cocoa trees up to maturity and then cutting down the shade. The proper test as to whether cocoa can best be grown in Trinidad with or without shade, is to endeavour to grow cocoa with and without shade right from the seed. I do not think that has been done as yet in Trinidad.

Professor P. Carmody (Trinidad): I would like to make a few remarks in connexion with this subject as I have given a little scientific attention to the shade tree used in Trinidad. Mr. de Gannes, who is an experienced planter and works his estate himself, will tell you that cocoa cannot be grown in Trinidad without shade. It is natural to assume that when cocoa trees were first planted here no shade was tried, but it was subsequently resorted to in consequence of failure. It seems to me unreasonable to suppose that a man would begin to plant Immortel trees before he knew they were required and then plant cocoa. I incline to the opinion of Mr. Howell Jones, that the question of shade or no shade depends upon local circumstances. From analyses of the flowers of the Immortel tree made in 1901, I ascertained that some of them contained as much as 6 per cent. of nitrogen calculated on the *dry* flowers. This large percentage naturally attracted my attention and further investigation was made which led to a report to the Government.

Mr. J. G. de Gannes: About forty years ago a gentleman came here and started cocoa cultivation His idea was that we were making a mistake in planting shade trees. He planted cocoa, raised with temporary shade, and then cut down the shade. When the shade was removed the cocoa trees stopped growing and he lost everything.

Dr. Van Hall (Dutch Guiana): In the question of shade trees we are just in the same position as planters are here in Trinidad. There is a general idea that cocoa cannot be grown without shade in Surinam. There is only one estate where it is grown without shade. One thing of great importance with that estate is that it can be irrigated in the dry season. On other estates, where attempts have been made to grow cocoa without shade, the trees generally suffer very much when the dry season comes. In my opinion it is very difficult to grow cocoa without shade in Trinidad; when grown

without shade it must be cultivated in another way. First your soil must be better tilled when no shade tree is used, because the shade tree is an improver of the soil and when you lose such an improver you must do yourself what is more or less done by the tree. Another thing planters do not understand is this: the shade tree is also a windbreak, and when you remove the shade you must take care that your trees are in sheltered position. Then the question of irrigation is, in our country also, a matter of importance. If you do not use shade trees and do not till your soil better, the soil suffers from drought in the dry season, and irrigation will be necessary to keep your cocoa trees alive. It is not necessary in plantations where there are shade trees. These and similar matters are often overlooked by planters who try to grow cocoa without shade. Another thing is this. As in our country, where the wet season is followed by three very dry months, you have to remove your shade trees not at once but gradually; and that is perhaps one reason why the experiments which some planters tried were unsuccessful. My Department is now trying an experiment with young trees. We have removed the shade from a field of about 2 acres, leaving some wind-breaks, and the first year, at any rate, this was a success, because, contrary to the expectation of many planters, when the dry season came, none of the trees suffered. In the second year, however, we had a very bad dry season and the trees suffered more or less. Yet planters were very astonished that they were still in good condition. It seems to me that once shade is properly removed, cocoa can be grown in Surinam without shade.

COCOA CULTIVATION AND GREEN DRESSING.

Dr. Francis Watts (Leeward Islands): The question of the treatment of orchard soils was brought up at the previous Conference, when I put forward views urging in substitution for excessive tillage and keeping the land clean in orchards, the adoption of a system of green dressing, or the use of weeds and shrubs for manures. This has all along existed in Dominica. The weeds are allowed to grow, and at intervals these are cut down without materially disturbing the surface soil; the cuttings are either used as a mulch, or they are treated as a green dressing and bedded in. The crop that has been found most useful so far appears to have been woolly pyrol. I have had some experiments made with other plants, but not to a very great extent. I have recently put forward some analyses which I believe will appear in the next issue of the *West India Bulletin* [Vol. V pp. 287–8] showing the proportion of manurial constituents which may be returned to the soil on each cutting. This is very largely practised in Dominica, especially where it is shown that the amount returned is very considerable. I have had occasion at certain times to examine soils. I will take one case, namely, Frenches, where Mr. Scully follows this system of cultivation Around each tree he keeps a space of about 10 feet perfectly free from weeds: the remainder of the land remains largely untilled; the weeds are cut down and either are left as a mulch to find their way into the soil, or are at once dug in. I think it would be wrong to allow the formation of anything approaching a permanent grass sod, and perhaps

that is the point where I find the greatest conflict of opinion. I think all agree that the surface of the soil must be light, loose, and free—nothing like a definite grass sod. There are some places in Dominica where in cutting down into the soil, one finds the conditions of natural virgin soil: the condition of tilth is maintained thoroughly. The great point is draining. On that subject I may have more to say at a future period. In Dominica it is a recognised method of cultivation, a cheap one, and a very thorough one, and I think it would be found better in practice, and tend to solve some of those difficulties to which Mr. Fawcett has referred, than keeping the soil absolutely clean. I have seen many cases where attempts have been made to keep the land perfectly clean and where the highest perfection used to be the absence of every weed; but in most cases I think that has been found to be most disastrous; the soil bakes hard and then a system of forking has to be resorted to.

ARTIFICIAL DRYING OF COCOA.

The desirability of drying cocoa by artificial heat, thereby rendering the planter more or less independent of atmospheric conditions, has long been realized in the West Indies. During wet seasons and in certain elevated districts of some of the cocoa producing islands considerable loss is frequently occasioned by 'mildew.'

Mr. G. Whitfield Smith, then travelling Superintendent of the Imperial Department of Agriculture, gave a brief sketch in the *West Indian Bulletin* (Vol. II, pp. 171-4) of the efforts that had been made in Grenada to dry cocoa by artificial heat, and gave, also a description of a cocoa drier since erected by the Department at the Botanic Station, Dominica. A further description of this drier will be found in the *Agricultural News* (Vol. I, p. 19) where it is stated :—

'The essential feature of this drier is the arrangement by which the hot air, on entering the drying box, is conducted along an air-tight flue or channel, and *is compelled to pass over and around the trays in succession*, beginning with the lowest. In this respect it is a great improvement on driers of a similar pattern used in Grenada and elsewhere, which have no interior divisions. In such driers it is found that the hot air on entering the single drying chamber naturally rises to the top, with the result that the beans on the upper tray were too quickly dried, while those in the lower tiers were only partially dried or, in some cases, remained moist.

'The drier above described is capable of dealing with 5 bags of cocoa at a time, and its original cost, including shed, stove, and fan, was £127. Where, however, the planter is able to utilize a spare building in which to place the drying box and stove, the cost might be reduced by about one half.

'For the information of those desirous of erecting a similar drier, it may be mentioned that the fan (18 inches) with belt and driving wheel might be obtained from the Blackman Ventilating Company, Limited, Head Office, 63, Fore Street, London E.C., at a cost of £9 6s., and the stove (Motts' Comet No. 28) from the I. L. Mott Iron Works, New York and Chicago, at a cost of £10 17s. 3d. The latter is sur-

rounded by a galvanized iron jacket to confine the hot air and to discharge it through the cowl into the drying box. The fuel may be wood, coke, or coal, as found most convenient.'

Subsequent trials have shown that cocoa can be dried within twenty-four hours of being placed in the drier without the fan being worked after 9 o'clock at night. The best results were obtained by maintaining a temperature of 110° to 120° F., with a good draught passing over the beans. Similar driers have been erected on private estates and have proved thoroughly successful. As many as 9 bags have been cured in twenty-four hours.

The members of the West Indian Agricultural Conference of 1905 had an opportunity of inspecting a patent cocoa-drying apparatus erected by Mr. Hoadley at Chaguanas, Trinidad. The following is a description of this drier:—

The cocoa-drying apparatus consists of an ordinary room 34 feet square, with 25 feet perforated circular drying floor, upon which cocoa is placed direct from the fermenting box. In the centre of the drying tray, is a vertical axe from which project four arms which are revolved once in ten minutes. To each arm are attached 6 ploughs the operations of which are equal to the work of twelve coolies in keeping the cocoa in constant motion. Hot air is generated by exhaust steam, which is passed into 1,100 feet of piping enclosed in a box, over which cold air is drawn by a powerful fan which makes from 600 to 700 revolutions per minute. The air in its passage becomes heated to any desired point up to 150° and is forced up through the drying floor. The machine will dry from 12 to 15 bags of cocoa in thirty to thirty-six hours. The cost of installing the system is said to be between £300 to £400.

After drying, the cocoa is passed through a machine which clays and polishes, or merely polishes to suit the markets, and thereby saves the costly process of dancing.

The cocoa is fermented in cylindrical drums, which are partially turned every night and morning for ten to eleven days.

728.—THE "COCKROACH" AS A POSSIBLE FRIEND TO THE CACAO PLANTER.

Recently a specimen of the Canker fungus of the cacao tree was brought in by the Senior Agricultural Instructor. The specimen showed an abundance of the "minute red *perethecia*" in the interstices of the bark, and was placed on a table in Superintendent's office. On examining it next morning, I could find only here and there a single perethecia, the rest having been eaten away by some insect, the suspected medium being the common cockroach. At present the consumer of the fungus is only suspected, but means will be taken to ascertain definitely if this insect really feasts upon the fungus or not; as it is a matter of importance in all cases to know the natural enemies of organisms which attack and cause disease in plants—the destruction of the reproductive organs of such a pest as the canker fungus by *any means*, at once marks out a line of attack which would

tend to keep the disease in check and if the cockroach can be proved to be the means of this destruction, it follows, that where there are plenty of these insects there will be little canker fungus—as the insect is actually destroying its means of reproduction.

729.—THE LATE THOS. CHRISTY, F.L.S.

To our extreme regret by last mail, we received news of the death on 7th September of the well known head of the firm of Thos. Christy & Co. of 4, 10 and 12, Old Swan Lane, Upper Thames Street. E.C., and of the Manor House, Wallington. Mr. Christy's efforts in respect to the introduction of new Tropical products have long been widely recognised, and in the direction of Applied Botany, his energy and enthusiasm were unbounded, and of the highest order. If anyone required seeds of new plants the advice was "Better try Christy." The writers connection with the firm dates some 25 years since, when he was supplying Cinchona seeds to the Jamaica Botanical Department. Subsequently we were officially indebted to his firm for things not otherwise easy to obtain, and were in constant receipt of hints and *memos* from his pen, of a valuable character. His suggestions for the packing of Tropical fruits, personally conveyed to me while last in London will be embodied in the information promised in following article. He will be greatly missed, especially by the writer, who now pays this small tribute to his memory.

730.—MANGOS AT THE COLONIAL AND INDIAN EXHIBITION.

The first consignment of Mangos sent by the local Committee while the writer held the post as Commissioner for Trinidad, arrived in excellent condition and fully ripe.

Some of this fruit was sent through the kind offices of the West India Committee to His Majesty the King, as recorded in last issue of this Bulletin. A smaller lot was sent to Sir William Thistleton-Dyer, K.C.M.G., Director of the Royal Gardens, Kew, who in acknowledging them states;—"*They seemed to me in superb condition and were quite a revelation. I congratulate you heartily on this splendid success.*"

Another lot was forwarded to the late Thos. Christy Esq., who wrote:—"*I have many years ago eaten mangos in the East Indies, but I never thought at that time that they could be brought to such perfection as those you sent me have arrived at.*"

Some were sent to Messrs. Monro of Covent Garden Market, who wrote:—"*Mangos useless, some too ripe, others had colour. We consider the one named mango D'Or to be the most saleable one. The*

Martin mango is in best condition, and if of good quality, that would sell, but the dark green spotted varieties are quite useless for market purposes here. On receipt of this, I wrote Messrs. Munro stating the opinions expressed by other authorities, and they replied that while they did not doubt the good faith of my correspondents they looked at the matter from the point of view of "*market value,*" and state: "*that it is useless a fruit being of the very best quality unless it has a good appearance as well,*" *as those really appreciating good qualities of the mango are few and far between.*"

This, from a well known salesman, shows the *ultra-conservatism* of the English market, and means that the salesman has no time on hand to prospect for buyers, and is disinclined to receive anything unless of handsome appearance, no matter what the quality may be.

The grower has therefore the duty cast upon him, to educate the British public, as to the quality of the best mangos. The time is within the memory of many of us, when the Banana was practically unknown in the English fruit trade, and yet to-day, we see its great popularity. The difficulty is, to get Mangos known among people able and willing to buy; to overcome which, I can suggest no better means than to send small samples to Clubs and to the entertaining nobility and gentry of England for trial. Once known! a market, and a good market too! will assuredly open. But we anticipate if we do this at once, for could a constant supply for a season be maintained. I do not think Trinidad is yet ready, but from the large numbers of grafted plants bought annually at the Experiment Station, it is certain that in a short time, this Colony will be in a position to offer and maintain a constant supply during the season of ripening, which being coincident with the "London Season" makes the possibility of a market feasible. We have had the approval of the few, and should now grow plenty, and supply the many.

It is certain that mangos can be well carried if properly packed. The writer as long ago as 1879 sent mangos to Sir Joseph Hooker, K.C.S.I., then Director of the Royal Gardens, Kew; and I have yet in my possession his letter of appreciation. The first consignment sent to the Palace came well, but later consignments, *differently packed*, were utter failures, and in a state of fermentation on arrival. Before the crop of next season comes in, it is the intention of this department to publish a short memo on the method of packing which experience has proved to be most successful, as it is only by due attention to this most important point, that a trade in this fruit can be established.

731.—COCO-NUT DISEASE.

One of the first things I received instructions to investigate after my return from England on 1st August last, was a disease, stated to be prevalent among coconut trees on the West Coast of Trinidad. I visited the estate on which it was said to be prevalent, and found the case had not been overstated and that an expert investigation was urgently necessary. In my preliminary report to the Government, it is pointed out that the disease appears to be similar to that recorded

in Kew Bulletin, Vol. 1893, p. 41, and on examination of specimens I found Bacteria and Fungi, in large quantity on diseased leaves and tissues. A Fungus provisionally determined as a *Pestalozzia*, was found on the leaves. It was recommended in the report from this Department that the services of the mycologist of the Imperial Department of Agriculture should be secured, and action has been taken by the Government for that purpose.

Sir Daniel Morris, K.C.M.G., while passing on his way from Jamaica, visited my office, and I had the opportunity of showing him what I had found and of describing the condition of the trees *viva voce*. After a full discussion, it was decided by Sir Daniel that it would be better in the first place for his staff to begin by the examination of the infected material, and for that purpose a large supply has been kindly sent up by the owner of the estate, which was forwarded to Barbados, by mail of 4th October. After this has been carefully examined, it is intended to make (if necessary) a full field examination. It is of course yet too early to say what is the real cause of the death of the trees, but the investigation now commenced under direction of the Government will, it is hoped, result in determining the cause, and providing a cure if possible: or failing that, suggest preventive measures which will mitigate the evil.

Bud Rot Disease in Coconuts, Gulf Coast, 1905.

PRELIMINARY REPORT, BY MR. J. H. HART.

[*Read before The Agricultural Society, 12th September, 1905.*

In accordance with instructions I proceeded on 17th instant to *La Retraite* Estate, Cedros, to make enquiries as to the state of a disease reported to exist among coconut plantations on the Gulf Coast.

2. Under the guidance of Mr. Greig, I examined the fields, witnessed the cutting down of a typically infected tree, and personally dissected and secured from it the necessary specimens for microscopical observation.

3. My observations lead me to conclude that the Plantation itself affords distinct evidence that there has been for many years a succession of deaths among the trees on certain areas which latter appear to have been replanted several times over. In my opinion this is strong evidence that the disease is not new but has been present in more or less severity for years.

4. A primary microscopical examination shows Bacteria in great quantity in the affected parts and especially in the heart, or growing portion of the tree. One of these which is seen in the greatest number is similar to the Bacterium causing *Tetanus* or lock-jaw, (*i.e.*) drumstick shaped. The tree examined was found to be infected from the ground upwards and when the stem was cut through a ring of

red discolouration was found lying between the woody exterior and the cellular interior parts of the stem. This discolouration became more prominent as it reached the growing points and appears specially to infect the base of the leaf stalks and the base of the embryo spathes enclosing the flowering organs. These eventually become quite rotten and putrid, the leaves fall and the tree gradually dies, the "heart," "cabbage" or bud becoming completely rotten.

5. In *Kew Bulletin*, Vol. for 1893, p. 41, a disease called Cocoanut "Fever" is discussed, and British Honduras, Jamaica and Demerara are mentioned as places where it has been observed. The description given of this disease appears to leave little doubt as to its identity with that now being examined in Trinidad. As in Trinidad, this disease is reported to occur where no damage has been done by the Palm Beetle (*Rhyncophorus palmarum*).

6. The fact that bacteria and fungi have been found is but a preliminary step in the enquiry, as it has yet to be proved which organism is the *author or cause of the damage*. To prove this is no easy matter as it necessitates a series of experiments to show whether the disease can be actually reproduced by artificial infection with organisms taken from an infected source. Once the origin is proved subsequent work would be devoted to the discovery of protective or remedial measures to devise which before the origin is ascertained would be a hopeless task. So far as can be ascertained no reliable remedy has yet been propounded.

7. The study of the disease in a proper manner will take up more time than is at the disposal of the writer, as the necessary experiments require undivided attention.

In my opinion, however, the service is *urgent*, and I would respectfully urge upon the Executive the necessity of affording Government aid for the purpose of making a thorough investigation, and suggest that such arrangements should at once be made as would secure the services of the Mycologist attached to the Imperial Department of Agriculture.

This Officer could make use of the Laboratory attached to the office of the Botanical Department for experiments after carrying out the necessary field work, and I should then be in a position to render him every assistance in my power.

8. It is to be noted that the American scientist, Busck, whose name has been quoted in connection with the disease, is an Entomologist and not a Mycologist, and therefore the opinion expressed by him is of little value until fully confirmed, which *may* or *may not* occur.

In the meantime such experiments as suggest themselves for the purpose of throwing light upon the origin of the disease will be undertaken by the writer, and such may prove useful as preliminary steps to a more thorough investigation.

J. H. HART, F.L.S.

24th August, 1905.

732.—THE TANNIA.

Owing to its producing one of the staple foods of the working classes in the West Indies, the class of plants of which the Tannia is a member, has been the subject of a careful investigation at the Experiment Station at Porto Rico.

Mr. O. W. Barrett, the author of the pamphlet recording the results, was in Porto Rico for some years, but has since been withdrawn for duty at head-quarters in the United States.

The work done is excellent, and the results are recorded, so simply, that one is apt to wonder why the work was never thought of before.

Mr. Barrett observes that we have two distinct plants under the name of Tannia, and he describes the best kinds for cultivation. The author appears to prefer the Spanish name *Yautia* or *Malanga* to the name of Tannia by which the plants are known in Trinidad.

He shows that the Taro of the East is a different species to the Tannia of the West, but curiously enough omits mention of the "Dasheen" which probably belongs to the plants of the East, while the ordinary Tannia is considered a native of the Western world, and known under the name of *Xanthosoma*, to which genus all the West Indian plants belong.

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733.—THE SPECIAL QUALITIES OF PLANTS.

By J. H. Hart, F.L.S., Supt. Royal Botanic Gardens, Trinidad.

1. The influence of the soil on the special qualities of agricultural products.

2. Are the special qualities possessed by plants sufficiently regarded?

It was at first intended that the subjects standing in my name should be taken separately, but they are so nearly connected that it has been deemed preferable to discuss both propositions under the one head.

In dealing with the influence of the soil, I would point out that it is only the *special qualities* that I propose to consider, and that such points as increase in size or quantity of produce are not under discussion.

An idea exists with many untrained tropical planters that certain soils are able to change the character or *special qualities* of plants and their produce. On the other hand, there is no little evidence that such special qualities are inherent to certain individual plants.

In a paper read at the Conference of 1899 (published in the *West Indian Bulletin*, Vol. I, pp. 123-33), I discussed 'Improvement in Agricultural Methods, and pointed out the means by which produce might be improved by the acquirement of varieties of plants by careful selection of the most suitable from the numerous varieties obtained by seminal reproduction.

In not a few instances I have met with positive statements, urging that changes in the special or inherent qualities of plants and produce are, in a large measure, due to the influence of the soil; and the makers of such statements appear to understand that the soil alone is able to induce such changes.

If I may be allowed to change the form of my first proposition and put it in the form of a question, the point may, I think, be made clearer for discussion: Can the characters or special qualities of produce afforded by plants *of one kind* be materially or permanently changed or altered, by the influence of the soil?

In using the words 'one kind' I do not intend them to cover the numberless varieties produced from seed, as these are well known to be subject to wide variation, but only those plants which are propagated in pure strains, by budding and grafting, or, as it is sometimes termed, 'vegetative reproduction.'

It will, I think, be obvious to most of us that the two conditions are essentially different as it is fairly clear that either degradation or improvement may follow when plants are raised from seed, while, on the other hand, special qualities or characters can be indefinitely secured, by means of vegetative reproduction.

It may, however, be truly asserted, that produce can, and often is, improved by cultivation on a good soil, and that the measure of improvement mainly depends upon the amount of plant food present, and the methods of cultivation used to render it available.

It can also be shown that quality may be improved by manipulation in preparation of produce; as in the fermentation and drying of cacao, etc. Changes effected by manipulation are, however, somewhat limited, and it would be next to impossible to make inferior material into first-class produce by such means, although it certainly may be considerably improved. As an illustration, I would point out that Calabacillo cacao, prepared by the very best method, can never be compared with the finest strains of Criollo or Forastero, similarly prepared. It is evident that Calabacillo must always remain inferior, because, in special qualities, it is originally inferior. We cannot in fact, to use a common expression, 'make a silk purse out of a sow's ear.'

Changes of this class are, I consider, minor improvements, but cannot be regarded as referring to special qualities. The latter may be defined as the factors which separate inferior from first-class produce.

It becomes evident, therefore, that, where first-class kinds are planted, the produce can be confidently relied upon, provided of course, that it is properly grown and handled. Even if handled without care, such produce is often far superior to that which belongs to an inferior class.

On further study of the matter, we find very strong evidence that plants showing special qualities, if reproduced by budding and grafting, will maintain their qualities under varying conditions of soil, *i.e.* they will not materially change.

Who, for instance, could change a white into a black grape, or a Julie into a Gordon mango, by the influence of the soil? A special quality is essentially an individual characteristic possessed by a certain plant not subject to serious change from the influence of the soil. That changes of a kind can and do take place is easy to discover: but they are merely such as would leave a white grape still a white grape, and the Julie mango still a Julie, and nothing else, wherever planted.

Plants are known to have retained, or to have maintained their individual qualities and special characters for centuries no matter where, how, or in what kind of soil they have been planted.

The effect known to be produced upon plants by a new environment may effect them to a certain degree, but it is probable that the influence of the soil is a minor factor even in this case, and can, from a cultivator's point of view, be practically disregarded when dealing with plants indigenous to, or imported from, a similar climate to that in which they originated.

Professor D'Albuquerque, in discussing chemical selection of sugar-cane at this Conference, gave strong evidence in favour of the permanence of individual special qualities in plants. He showed variation and improvement, but in the end all came out alike—that is, the special qualities were unaffected.

In support of the statement that no material change occurs, I would mention the continuance of the special qualities in the varieties of European grapes, apples, pears, plums, etc., under cultivation. The Ribston Pippin apple, first recorded some three hundred years ago, has continued to maintain its special qualities, although cultivated on all classes of soil and in all climates in the temperate zone. It is still the Ribston Pippin; and by a late census, taken during 1904, it is placed about fourth in the list of dessert apples, in English collections. Had its propagation been left to reproduction from seed, in the manner cacao has been for so many years, it certainly would have long since disappeared as a variety possessing special qualities; but by the aid of continuous vegetative reproduction, this apple has been handed down from father to son for many generations, and still stands among the first of its class.

In Europe and America similar illustrations are abundant; but they have been exceedingly rare in the West Indies until in very recent years, when a commencement was made in perpetuating special, selected varieties of the mango, orange and other fruits, by budding and grafting.

The sugar-cane and the pine apple afford two instances in which special characters have been maintained, and we find in these two instances, that the plants have been propagated by cuttings and suckers, which are processes of 'vegetative reproduction.' Both are now being propagated from seed, with the result that many new varieties have been secured by selection from thousands of seedling kinds, each of which may, by the means mentioned, be perpetuated at will.

The supposition that the soil changes plants may possibly have arisen from the natural variation which occurs among plants raised from seed, a fact which has been insufficiently noticed, or regarded by the general cultivator, and even if noticed, has been wrongly attributed to the influence of the soil. Reproduction from seed is clearly the best method of securing new varieties, but unless combined with careful selection, it gives rise to sets of plants showing a mixture of both good and bad qualities, the latter being generally the more numerous. It is therefore evident that a process of raising seedling plants without selection must inevitably tend to the deterioration of any class of plant so raised.

Once found, however, a special quality can certainly be perpetuated. This brings up our second proposition, namely: Are the special qualities of plants sufficiently regarded?

It is a well known fact that among progressive agriculturists these qualities are considered of the highest importance, and as such, are being earnestly sought. So much is this the case, that it has formed a fully sufficient *raison d'être* for the establishment of modern experiment stations in most countries where agricultural work gives employment to a large proportion of the population. The duty of such stations is to search out and perpetuate the newest and best varieties, to test such, and to bring them into cultivation.

Hitherto such work has not been sufficiently regarded, but I am glad to be able to say that, among the planters of Trinidad, there are those who now take the greatest interest in it; but still there is a large number of planters who do not as yet realise the vast importance of having under cultivation the highest class of plant which it is possible to secure.

I have but briefly opened the two propositions submitted for the consideration of the Conference, and it will be noticed that I have not said as much for the influence of the soil as I have for other influences. It must be remembered, however, that I have merely touched upon the subject, and have not attempted to exhaust it, for or against, either proposition. Personally, I believe the subject to be of the very highest importance, and that the special qualities of plants should be much more widely considered than they are to-day, especially among cultivators who have had no opportunity for practical training or careful study in the theory and practice of agriculture.

I now offer the subject for discussion, pointing out that the main object of the paper is to bring prominently to view the immense importance of selecting and growing pure strains of high-class plants, and of propagating these by vegetative reproduction. The common and untrustworthy method of using unselected seedlings is a practice which is fraught with danger to the prosperity of the country in which it is pursued, while, if the qualities of individual plants are sufficiently regarded, and the methods I have suggested adopted, I believe it will result in raising the value of the produce grown, to the benefit of the cultivator, and of the country in which he lives.—(*West Indian Bulletin*, Vol. VI, No. 2.)

734.—THE IMPORTANCE OF SELECTION IN VEGETATIVE PROPAGATION.

By W. R. Buttenshaw, M.A., B.Sc., Scientific Assistant on the Staff of the Imperial Department of Agriculture.

The question whether plants propagated by vegetative processes could be improved or permanently modified by selection has often been debated. In most of the processes of vegetative propagation the new growth is merely an extension of the growth of the parent, and consequently, the new plant produced in this way is much like its parent. But since even among the different branches of one tree there can be variation—sometimes sufficiently obviously to become a 'bud spot'—it is easy to imagine that cuttings produced from the same parent may develop considerable variation.

It is well recognized by gardeners that a new individual produced from a cutting possesses certain characters which may or may not differ from all other similar parts of the parent plant; in other words, hardly any two cuttings possess exactly the same characters; that it is also necessary to make use of careful selection when propagating plants by a vegetative process is therefore apparent.

A very complete series of experiments has been carried out by Messrs. B. T. Galloway and P. H. Dorset, of the Division of Vegetable Pathology of the U. S. Department of Agriculture, to determine to what extent violet plants could be improved in productiveness, vigour, and ability to resist disease by a careful selection of cuttings. A detailed account of these experiments is given by Mr. Herbert J. Webber in the *Year Book of the U. S. Department of Agriculture* for 1898 (pp. 373-5). He says: 'The results already show that productiveness is remarkably increased, and they also clearly demonstrate that violet cuttings can gradually be improved by a continuous selection of the cuttings used in propagation and of the plants from which these are obtained. The method consists in selecting a number of the finest looking plants before they begin to bloom, placing beside each a stake to which a blank tag is attached, and carefully recording on each tag the daily pick of saleable flowers from the plant, so that at the end of the season the number of flowers produced by each plant is known. The cuttings for the ensuing year are taken only from the plants producing the greatest yields, and which are known from continual observation through the season to be desirable in other ways. The pedigree cuttings thus obtained are again subjected to selection, and only those which root well and form good, vigorous, young plants are finally used.

The following is an interesting example of the nature of the results obtained: Five plants were selected from a plant which, in the previous season, had yielded eighty-five flowers. Three out of these five gave a much greater yield than the parent (127, 109, and 103), the remaining two gave eighty-two and eighty-four, respectively. The average yield of the five plants is thus 101, or sixteen flowers more than that of the parent.

Selection in vegetative propagation is also of assistance in producing a healthy strain of plants. Webber gives an account of experiments with the Ripley Queen pine-apple, which is liable to a disease which causes it to 'go blind,' that is, advance to the end of its growing period and sucker from below without fruiting. The experiment consisted in planting in one bed suckers from diseased plants and in an adjoining bed suckers from apparently healthy plants. In the former bed, eighteen months later, he found that 63 per cent. had contracted the disease, while in the other beds slightly less than 4 per cent. showed the disease. This being the result of but one selection, it would seem probable that the disease might be completely controlled by a continuous selection of suckers from healthy plants.

Another interesting illustration of the modifications obtained by the careful and continued selection of vegetative parts—one of particular interest in West Indian agriculture—is the breeding out of thorns from citrus trees by bud selection. To quote again from Mr. Webber's article: 'Seedling oranges and lemons are almost invariably very thorny, but nevertheless the majority of the standard varieties cultivated are now largely thornless, owing, it is said, to the continuous selection of buds from thornless branches. According to the testimony of orange nursery-men, it is quite certain that thorns can be bred out in this way in every case, and usually to do so requires but three or four bud generations. It is probable, in the case of other fruit trees, that by selecting buds or cuttings from branches that are thornless, or which have fewer thorns than usual, the thorns could be entirely bred out, or at least the greater number reduced.

Writing in the *Bulletin of the Botanical Department of Jamaica* for November 1900 on the subject of budding orange trees, Mr. W. Cradwick says: "Buds with thorns attached should not be used; they do not grow so readily, and, if they grow, result in a tree on which long thorns will be one of the chief features. A tree grown at Hope from a bud with thorns $1\frac{1}{4}$ inches in length attached to it produced thorns over 8 inches in length."

In this connexion it may be useful to review briefly the interesting series of experiments in the chemical selection of sugar-cane conducted by Dr. Watts at Antigua:—

'The object of the experiment is to ascertain whether the saccharine content of the sugar-cane can be effected by selection of cuttings.' These experiments consist in selecting two series of canes canes— (1) canes rich in sucrose, called 'High' canes, and (2) canes poor in sucrose, called 'Low' canes. The experiments have now been in progress for four years. Each year the ten richest canes have been selected from the 'high' plot and the ten poorest from the 'low' plot. This represents an attempt to obtain two divergent series— 'one tending to increased richness, and the other to decreased richness.' In making the selection, the canes are examined by cutting off the basal portion in the middle of the fifth internode from the base, crushing this basal portion in the Chatanoga mill, and determining the amount of sugar by means of the polariscope in the sample of juice so obtained.

The result so far attained are as folllows :—

	Pounds of surcose per gallon.				
	1900.	1901.	1902.	1903.	1904.
Differences on canes planted,	·597	·526	·985	·463	·876
	1901.	1902.	1903.	1904.	
„ „ „ reaped,	·020	·218	·093	·199	

The difference on canes planted in 1900 and 1904, in pounds of sucrose per gallon, has increased from ·597 to ·876, an increase of 46 per cent. Similarly, the difference on canes reaped in 1901 and 1904 has increased from ·020 to ·199.

In considering this question it is essential that two points should be clearly distinguished. Briefly put, it is the difference between the maintenance of a 'sport' and a gradual improvement by selection. My meaning will be made clear by another reference to the case of budding out thorns from citrus plants. If a bud is taken from a spineless branch and the resulting tree comes spineless, then we may have simple perpetuated a sport. But can we rely upon all such buds being spineless? This would appear not to be the case, for Mr. Webber says: 'Standard varieties are now *largely* thornless'; and again, 'it is quite certain that thorns can be bred out in this way in every case, and usually to do so requires but three or four generations.' It is evident that we have here a *gradual* process, that the variations between spineless and spiny buds are not uniform but differ in degree, and, lastly, that *continued* selection is necessary before the spine can be eliminated. The same fact is brought out—but in the contrary direction—in the instance cited by Mr. Cradwick, where a tree grown from a bud $1\frac{1}{4}$ inches long attached to it produced thorns over 8 inches long; it is obvious that it would be possible here also to produce two divergent series of oranges—one becoming less and less spiny and the other tending to produce longer and longer thorns.—*West Indian Bulletin*—Vol. VI, No. 2.

(It would probably be difficult to find a "sport" or a product of "bud variation" which has stood the tests to which well known varieties of seedlings have been subjected for generations without reverting to an original type. The selection of healthy cuttings or buds is obviously a course which it is the interest of the cultivator to pursue for the elimination of all tendeney to disease, but the proof of improvement or alteration in the first special quality possessed by the parent is not apparently very strong. The change effectod in the spines of the lime and orange would assuredly be more easily and permanently effected by propagation from selected varieties raised from seed having no spines shown to be possible by the raising of a spineless Lime in Dominica. The subject is highly interesting and should be freely discussed.—EDITOR.)

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